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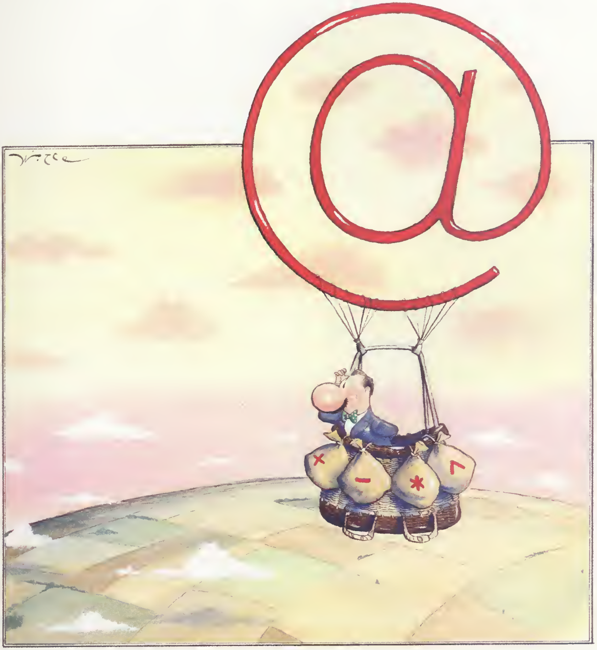

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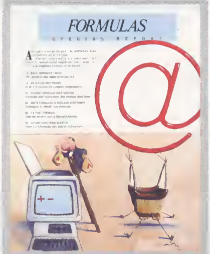

73 INTRODUCTION

74 BASIC WORKSHEET MATH
The well-known and lesser-known operators
BY ROBERT HILDEBRAND

76 AN @FUNCTION PRIMER
Built-in formulas handle complex computations.
BY PAULA DEMPSEY

81 CHOOSE FORMULAS OVER MACROS
They can analyze data faster than most macro routines can.
BY NICK DELONAS

84 WRITE YOUR FORMULAS IN BOOLEAN SHORTHAND
If you can count to one, you can shrink your formulas.
BY RICHARD CRANFORD

86 FIX THAT FORMULA
These debugging tips take the mystery out of flawed formulas.
BY E. MICHAEL LUNSFORD

91 @FUNCTIONS FROM SCRATCH
Fast, easy-to-use add-in @functions with *3-2-1 Gosub*
BY MALCOLM JOHNSTONE

FEATURES

44 A MACRO LIBRARY ADDRESS LIST
Keep your frequently-used addresses ready for immediate use.
BY MERDIN CRIDDLE

50 POPULATION FORECASTING
Are Census Bureau predictions realistic? It's not too difficult to produce your own.
BY EVERETTE S. GARDNER JR.

57 LIFE INSURANCE ANALYZER
This model tells you if your current coverage is adequate.
BY STEPHEN L. NELSON

60 COMPUTER SAVVY IN THE B-SCHOOLS
The trend is to teach students how to use applications rather than how to program them.
BY EDWARD B. FISKE AND BRUCE HAMMOND

68 WHERE DID I STASH THAT WORKSHEET?
Build an instant index to help you find all of them.
BY GLEN L. DAKE

---

4 STAFF LETTER

6 LETTERS

9 IDEAS & TRENDS
Macros Viruses; *Windows* 3.0; Interview: Matthew Carter; Printer Sharing; Printer Paper; Memory Crashes; Shorts

22 @LOTUS

25 START HERE
1-2-3: Database
BY DANIEL GASTEIGER

MACROS

32 1-2-3 MACROS
How to Build a Versatile Toolbox
BY NICK DELONAS

38 MACRO BASICS
A Faster Way to Copy
BY NICK DELONAS

40 @WORK
Symphony Typing Tester
BY NICK DELONAS

RESOURCES

94 Q&A

100 GOOD IDEAS

104 ADVERTISER INDEX

104 EDITORIAL EVALUATION

104 READER SERVICE CARD

REVIEWS

105 Three Ways to Make Friends with DOS
BY TOM CARLTON AND R. MARTIN TEMPLE

108 Expanded Memory Without New Equipment
BY BILL LAWRENCE

114 NEW PRODUCTS
Microsoft Word 5.0 Jumps Ahead of *WordPerfect*, and more

120 ESSAY
The Lotus Cross-Platform Strategy
BY JEFFREY TARTER

COVER: MICHAEL WITTE

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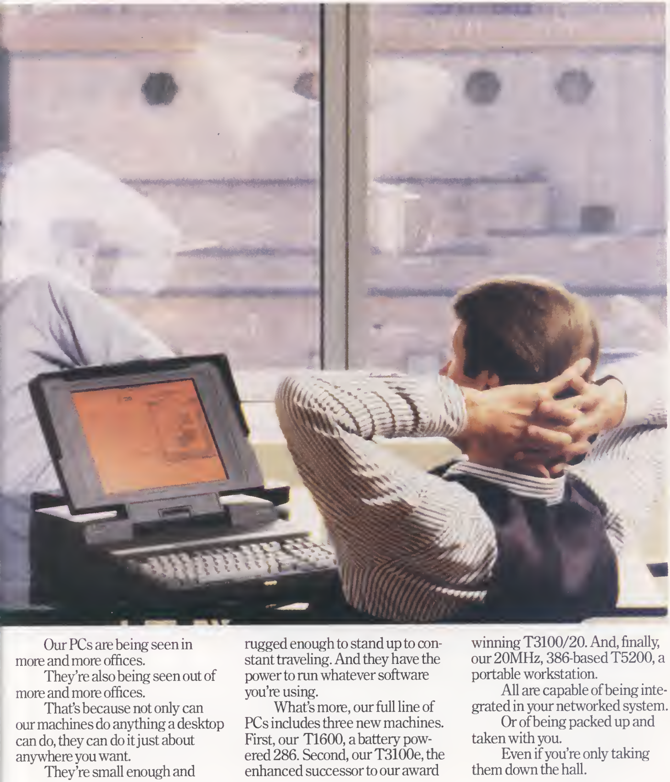

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STAFF LETTER

GOODBYE OLD RELEASES

We hate to do it. It's like leaving old friends behind. But we really don't have much choice.

Starting with the October issue, most of our articles will no longer provide instructions for using the first-generation releases of *1-2-3* and *Symphony*, where those instructions differ from later releases. By first generation, I mean *1-2-3* Release 1A, as well as *Symphony* Releases 1, 1.01, 1.1, and 1.2. We're also dropping *1-2-3* Release 2, the first of the second-generation releases, which differs little from Release 2.01.

Many of the models, macros, and tutorials we present will be partially or totally applicable to those older releases. But we leave it to you to determine the applicability in each case. Next month we will publish a guide that will help.

These changes will affect the 12% of you who use *1-2-3* Release 1A and the 6% of you who use first-generation *Symphony* releases. You're still important to us. But we know that, given the age of those releases, you are veteran users and not likely to be thrown by this change.

Still, we owe you an explanation. When we present a model or provide a solution in the magazine, we try—to the extent warranted—to tell you how to handle it in both *1-2-3* and *Symphony* and in all releases of each program. That means testing the model or problem under as many as eight different releases. It also means putting into the article a host of alternative keystrokes, which many of you have told us are frustrating to read through.

And now we have two new releases of *1-2-3* to contend with and more on the way. We just don't have the resources to deal with all releases and still maintain the level of accuracy that you've come to expect from us. That's not to mention the typographical confusion.

We will continue, for now, to treat *1-2-3* Release 2.01 and *Symphony* Release 2.0 as our standards. When we talk *Symphony* keystrokes, we will be talking Release 2.0. And when we talk *1-2-3* keystrokes, we will normally be talking Release 2.01. We may also talk *1-2-3* Release 2.2 and will signal this by using the designation 2.01/2.2. If a model or macro requires—or could benefit from—different keystrokes in *1-2-3* Release 2.2, we'll spell that out. Of course, you'll also see articles that are geared specifically to users of Release 2.2, as well as articles aimed at users of Release 3.

We'll make this all clear enough in the magazine, starting next month. I just wanted you to have advance warning. As for you second-generation users, we know that these changes will help us do a better job for you.

John B. Campbell
Editorial Director

LOTUS (ISSN 8756-7334) is published monthly by Lotus Publishing Corporation, a subsidiary of the Lotus Development Corporation, at One Broadway, Cambridge, MA 02142. Subscription rates, one year: U.S. and U.S. possessions, $18; Canada, $22; Foreign, $80 (airmail). Please allow four to six weeks for receipt of first issue. Executive, Editorial, Circulation, and Advertising Offices, P.O. Box 9123, Cambridge, MA 02139-9123. Telephone (617) 494-1192. ©Copyright 1989, Lotus Publishing Corporation, all rights reserved. *LOTUS* is a registered trademark. Officers of Lotus Publishing Corporation: Mark D. Flanagan, President; Robert P. Schechter, Vice President of Finance and Operations, Chief Financial Officer. Second-class postage paid at Boston, MA, and at additional mailing offices. Postmaster: Please send address changes to *LOTUS*, Subscription Dept., P.O. Box 56588, Boulder, CO 80322-6588

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PRAISE FOR ALLWAYS

In the article "Business Forms Go Electronic" [June, Ideas & Trends], I was surprised to note that you did not include any reference to *Allways*. I use *Allways* in conjunction with macros to replicate certain government forms and to fill in data from a database by using lookup formulas. I also use *Allways* to fill in blank forms where there are highly erratic line spacings and columm widths that would be extremely difficult to address with setup strings.

Roy S McCrary
L'Eggs Products Inc.
Norristown, Penn.

DESQVIEW: HOW MUCH MEMORY?

I was astonished to see your usually accurate magazine publish the statement that *Desqview* will perform context switching and multitasking "on any IBM PC–compatible computer" [May, Ideas and Trends]. This is potentially misleading to people without direct experience with *Desqview*. Anyone who has experienced the frustration of trying to get *Desqview* to perform any useful work will confirm that the product is virtually worthless without generous amounts of LIM-EMS 4.0 expanded memory.

Stephen T. Porterfield
Walnut Creek, Calif.

Editor's note: *The expanded memory helps a lot, but we have also done useful work within 640K.*

HOME OWNERSHIP: CASH FLOW VS. NET WORTH

In "To Buy or Not To Buy" [May], the Nelsons have created a reasonably useful model for evaluating the economics of home ownership versus renting. However, the model runs the risk of misleading readers because it does not distinguish between the cash flow and net-worth effects of home ownership.

The cash outflows from home ownership are tangible, and they are experienced every month. Sometimes this experience can be quite painful, especially if home ownership is more expensive than renting.

The increase in a home's value affects only a person's net worth. This increase in value is usually rolled into a person's next home purchase and is seldom converted into cash during the home owner's lifetime.

When the Nelsons mix current cash outflows with a future increase in net worth, as they do in their IRR and NPV calculations, they skew their calculations in favor of the net-worth effect. People considering the purchase of a home should be aware that the expenses related to home ownership are likely to have more immediate, personal impact than any future increase in the value of their home. This is not to say that the appreciation potential of the home should be ignored—only that it should be put in the proper perspective.

There are three other points to note about the model. It does not allow for a tax deduction for loan points paid by the purchaser of a home, which can be a significant cash inflow in year 0. In the formula in cell K8, the term $B$7*(1+$B$5) should be raised to the power of (G7−1). And last, the prevailing capitalization rate, which the Nelsons equate with the annual-income percent, does not necessarily bear any relationship to the savings that a person realizes by owning a home rather than renting. In my experience, every first-time home owner initially spends more on his house, even after taxes, than he did on his immediately preceding rental. Readers should note that the Nelsons' example is heavily slanted in favor of home ownership, due primarily to the factor they use for the annual-income percent.

Roy Weitz
Woodland Hills, Calif.

Authors' note: *Mr. Weitz makes a good point and may have missed a few important points, too. First, the model doesn't mix cash flows with net worth as he suggests. If you're assuming appreciation in the value of housing, the main benefit of buying a house rather than renting a house is that you lock in a stable, level housing expense rather than having to continue to pay more and more rent each year. Remember that, assuming 5% annual inflation, a house that rents for $1,000 a month now will rent for roughly $1,629 a month 10 years from now, roughly $2,653 a month 20 years from now, and 30 years from now—when a home owner might pay that last mortgage payment—$4,322 a month.*

If you doubt this, expand the model to, say, 30, 40, or 50 years and assume that you get no value from selling the house at the end of the forecasting period. In other words, your only benefit from owning a home stems from rent savings. The steps for expanding the model were outlined in the article.

Mr. Weitz's point about the deductibility of loan points is correct, but we don't think it materially affects the analysis. If you think it does in your situation, go to cell M7 and enter a figure for year 0 under the Income Tax Savings *heading. The formula for this would simply be closing costs times the marginal-tax rate, or B9*B13.*

The formula in cell K8 is correct as we published it. The model yields a conservative rental amount by multiplying the annual-income percent by the house value at the beginning of the year, rather than at the middle or the end of the year. Since the formula in cell K8 refers to cell G7, the formula already subtracts from the year. Subtracting 1 again wouldn't make sense.

Finally, with regard to Mr. Weitz's point about the prevailing capitalization rate, I think he makes a mistake that many people do by comparing, say, the rent they pay per month on a two-bedroom, one-bath apartment to the costs of buying a three-bedroom, two-bath house. It shouldn't be a big surprise to anybody that you'll always save money by living in less-expensive housing. But you can't make a valid comparison that way. What you want to consider is whether, for example, it makes more sense to rent a three-bedroom, two-bath house or to buy a similar three-bedroom, two-bath house. The annual-income percent is simply the rent you'd pay on the three-bedroom, two-bath house divided by the purchase price of the house.

RUNNING TOTALS WITH @SUM

In "8 Better Ways" [May] you suggest a way to calculate a running total by using @SUM. I have found it much less time-consuming to enter +B4 in cell C4 and +C4+B5 in cell C5, using your figure on page 48 as an example. Cell C5 can then be copied for the length of the worksheet in column C.

As business manager of the Cook County Department of Public Health in Illinois, I use a similar formula instead of the Data Fill command. The county mandates a five-digit requisition number beginning with the number nine. To accomplish this on my requisition log, I type the first number (90001) in cell A1 and follow it with the formula +A1+1 in cell A2. The formula in cell A2 can be copied the length of the worksheet. I use the Range Value command to remove the formulas.

Jerome D. Klein
Oak Park, Ill.

Editor's note: *Your technique for calculating running totals may seem less time-consuming, but it does not solve the problem of errors created in formula columns by one or more deleted worksheet rows. Using the @SUM approach does.*

Your technique for using a formula rather than the Data Fill command won't result in errors, but it is the hard way to fill a range with values. Why not specify 90001 as the start value and 1 as the step value? Take this approach and you don't even need to convert formulas to values.

The disadvantage of using the @SUM function instead of cumulative adding is that it takes about 40 times as long to recalculate. I tested this by using the Data Fill command to create a column of 400 numbers. Then I used both running total methods and timed them by counting the number of times the *Wait* indicator blinked.

Millard Cummins
Thurman Manufacturing Co.
Columbus, Ohio

The second "better way" describes a way to copy an absolute formula using the File Xtract command followed by the File Combine command to get an absolute formula at a new location. While I find this method ingenious, I see a problem with doing this very often.

Every time you extract a file, you create a small worksheet on your hard disk. At some point, either in the near or distant future, you are going to have to erase this little goodie—a few more keystrokes devoted to maintenance.

On the whole, it would appear easier to cycle through the ABS key a few times, copy the relative formula, and recycle the original back to absolute. It takes 24 keystrokes to do it your way and erase the temporary file. Doing it the cycle way takes 29 keystrokes. The difference will affect your hard disk. Unless you are frequently running a disk optimizer, you will begin to create many unused clusters, which can eventually impede disk performance.

Alan W. Joyner
Fredericksburg, Va.

If the @SUM functions you used to calculate running totals specified $B$3 instead of $B$4, deleting row 4 would not cause an error.

Whenever there are labels at the top or bottom of a column, specifying the labels as the ends of the range will allow either the top or bottom data row to be deleted without causing an error in an @SUM (or similar) function result.

John Olson
Alpine, Tex.

Authors' note: *Mr. Cummins makes a valid point. It takes significantly longer to calculate running totals with @SUM functions than it does with simple addition formulas. Therefore, the simple addition method may be preferable in many cases—especially when you are working with a large number of values.*

Mr. Joyner's point is well taken. However, instead of specifying a new file name each time we use this technique, we reuse the same file. That way, there is only one temporary file on our hard disk. Furthermore, since we usually use this technique to copy only a single formula at a time, the file remains small. In any case, using the File Xtract and File Combine commands saves time for all but the simplest formulas—even if you count the time required for the optional step of deleting the temporary file.

Mr. Olson is right. In fact, the benefits of including an extra row at the top of a sum range were explained in "Doug Cobb's Fifteen Essential 1-2-3 Tips and Tricks" (October 1986).

SETUP STRINGS

In "Setup Strings Can Control Printing" [March], you mention that if you desire a special printed effect in a certain section, you should lay out that section in a row-wise format rather than a column-wise format. I haven't the slightest idea what you are talking about.

Lewis K. Johnstone
North Redington Beach, Fla.

Author's note: *Sorry I confused you. "Row-wise" format means that the major elements of a model are organized across, rather than down, the worksheet. For example, to print a series of 12 monthly cash flow values in emphasized print, you should enter the values across a single row of the worksheet, say in range A5..L5. You can then embed setup strings immediately above and below row 5 to specify emphasized printing.*

$18,000 PER WORKSTATION

"Effective Application Design" [February] began with the following three statements: "Each PC user costs a corporation roughly $18,000 per year, according to a study by Nolan, Norton & Co. The single largest part of that cost is support and training. Surprisingly, software and hardware are a minimal part of the total."

I find $18,000 hard to believe. Could you tell me how they got this figure?

Emily Rhoades
Spencer, Ind.

Editor's note: *Ronald L. Evans, at Nolan, Norton & Co., explained the breakdown of the $18,000. This is an annual figure per workstation, not per PC user, as indicated in the article. Here's the breakdown: 18%, or $3,300, for hardware; 9%, or $1,650, for software; 39%, or $7,000, for corporate support; 2%, or $300, for data access (the cost of downloading corporate mainframe data); 7%, or $1,300, for training; and 25%, or $4,450, for business-unit support (the cost of supporting someone who has learned the system plus the cost of the time it takes the user to learn the system).*

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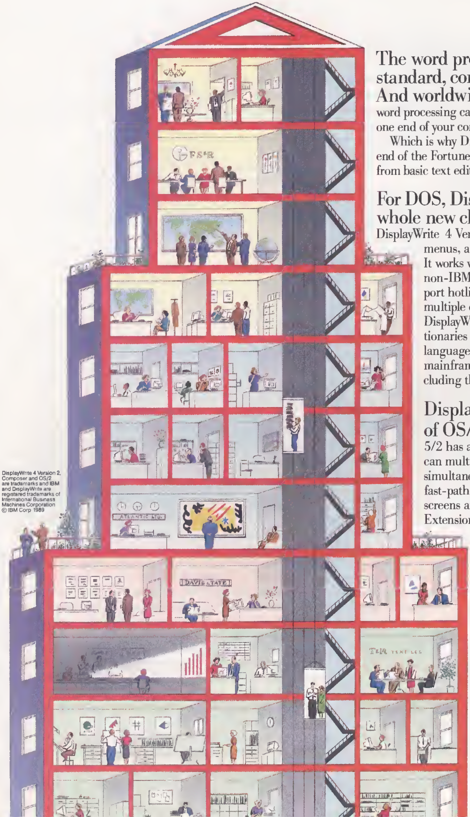

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THE SPREADSHEET MACRO VIRUS: IS IT REAL?

It is the PC user's newest nightmare: a virus implanted in a spreadsheet macro that migrates from worksheet to worksheet, undetected by existing antivirus programs. In its most evil incarnation, the virus erases itself after subtly altering a spreadsheet's data, leaving no clue as to what caused the dirty work.

It may be only a bad dream—for now. But some computer security experts believe that the dream can become a reality.

"We really think this is a lot of smoke and mirrors," says Dan Rattner, manager of protective services at Lotus Development Corp., who is somewhat irked that the rumors of a macro virus most often have it attacking *1-2-3*.

Our reporter chases many a rumor, but fails to find a 'Lotus macro virus.'

Even so, Lotus has taken steps to alert new customers to data-security problems. And because of more-powerful macro capabilities, the new releases of *1-2-3* (2.2 and 3) may be more vulnerable than Release 2.01 to certain types of data-destroying viruses.

Accounts of the virus are something like sightings of the Loch Ness monster.

MARCEL DUROCHER

There are plenty of elaborately detailed stories making the rounds, but nobody confesses to encountering the beast in the real world. Then again, nobody has disproved its existence.

Hard to detect

"The Lotus virus is real," insists Jon David, a Tappan, N.Y., computer security consultant. "I can't give you names and companies that have been hit by it. But from people in my position whom I trust, I understand that some companies have been hit by macro viruses."

The stories go something like this: The victim imports a spreadsheet template that contains a malicious autoexecuting macro. When the spreadsheet is called up, the macro unobtrusively alters data one cell at a time. Before it is discovered, the virus has not only spread to other worksheets but has also corrupted the user's backup files. Because it lurks in data files, the macro moves unnoticed by antivirus products that normally monitor only executable programs.

"How many people look at the data to see if it has been changed?" asks Michael S. Riemer, executive vice president of FoundationWare Inc. and chairman of the Software Publishers Association's panel on security. "The whole problem with this supposed virus is that it is very insidious."

Stories about a macro-based virus that attacks *1-2-3* were a hot topic at the Comdex/Spring trade show, says Pamela Kane, the president of Panda Systems (Wilmington, Del.). "People were speaking about it as though it were a fact," says Kane, who devotes a chapter of her new book, *V.I.R.U.S. Protection* (Bantam Books, 1989), to "The Dreaded Lotus Computer Virus."

Computers & Security, the International Federation of Information Processing computer-security journal, in its May issue was first to go public with a story about spreadsheet viruses. Dr. Harold Joseph Highland, the magazine's editor, wrote that he had initially dismissed rumors as "part of the mass hysteria" about viruses. But two inquiries from European security specialists piqued his curiosity. "We had the impression that they knew more than they said," wrote Highland. "From the details given about how the virus worked, it was more than likely that one or both of these virus hunters had encountered a live version of the virus."

Small data changes

Highland, however, was unable to put his hands on the real thing, so he did the next best thing. He had his associates write "a simple, demonstration virus" for *1-2-3*. The autoexecuting macro, which is called \0 in a worksheet, did as it was told: Each time the worksheet was loaded, it searched a specific column in the spreadsheet and altered a number by a small percentage.

Highland is not the only computer-security expert who has explored the hideous possibilities of a macro virus. Ralph Spencer Poore, senior manager of Ernst & Winney (Baltimore), one of the Big Eight accounting firms, wrote an autoexecuting macro for *1-2-3* that replicated itself on other spreadsheets. "We are able to show that a macro virus is possible," he says, "and not just in *1-2-3*, but in a whole slew of products."

At a computer confab this spring, Poore mentioned his findings to some Lotus officials. "We explained to him that we were not really thrilled with his using *1-2-3* as a hypothetical case," says Rattner.

It was not the first time Lotus officials had heard about a virus designed to attack *1-2-3* spreadsheets. They deny, however, that they have ever seen such a thing. "These people swear up and down that they've seen them, but they haven't sent us a copy," says Peter C. Dichard, a software engineer at Lotus.

The security experts who have dabbled with writing the macro viruses say their intent was only to prove that such a creature is possible. "My response to that is, So what?," says Rattner. "*1-2-3* is a programmable product. You can make a macro that does good things and one that does bad things."

Lotus officials say that it would take very little imagination to write a macro

HOW YOU CAN AVOID A MACRO VIRUS

Many computer security consultants contend that the chances of being victimized by a computer virus are remote, but you can minimize the chances by taking the same precautions that apply to using any unknown software.

"It's part of the larger security issue," says Pamela Kane, president of Panda Systems (Wilmington, Del.). "In this day and age, anybody who uses an overlay or a template without carefully testing it first is asking for trouble."

Harold Joseph Highland, editor of the journal *Computers & Security,* has examined the possibility of a spreadsheet virus. He writes that "simple detection procedures can prevent data corruption." He recommends that users examine a macro with the Explore Disk of *The Norton Utilities,* which lets you examine, search, and edit all areas of a disk. He acknowledges that the chore "is not a job for an amateur."

But simple prudence will probably suffice. Security experts advise that users take several precautions, many of which are also included on a list of "data security hints" that Lotus is including with instructions for Release 3.

"There's nothing magical about them," says Dan Rattner, manager for protective services at Lotus Development Corp. "Our main goal is to sensitize people about what they're doing when they're loading a macro."

This is what some security experts recommend:

- If you already have a macro virus, avoid backing up your data. Backing up data tends to spread a virus.
- If you don't have a virus, frequently back up data from each spreadsheet in a nonspreadsheet format separate from your macros. Keep multiple generations of your backups instead of reusing the same disk.
- Do not download macros or other programs from electronic bulletin boards, and do not share public domain software unless you are confident of the source. Be wary of disks and macros that new employees bring from their former organizations.
- Check the results manually the first time you use a macro, and spot-check them thereafter. Check numeric data each time you call up your spreadsheet, especially totals.
- Secure computers and software when not in use.
- Always start your system from the hard disk if it has one. If not, start from a write-protected system master disk. Be sure the master disk is your own.
- Check macros regularly to ensure that no one has been tampering with their code.

—*A. M.*

that simply trashed every worksheet on a disk. Hence, they urge users to make frequent backups, good advice under any circumstances.

But the strains of virus described by outside computer experts are more insidious and harder to detect than a macro that simply destroys all the data in a worksheet. Security consultant Jon David described a hypothetical virus that "takes a data file, inverts adjacent bytes every 17th record, and then goes dormant for 10 days." It also manages to replicate itself in another worksheet at the same time. "It's going to be a long time before you realize there's a problem," he says, "and by then, all your backups are messed up."

Noninfectious viruses

However, this and other so-called laboratory macro viruses may not really work in the real world. Scott Tucker, coauthor of the book *Inside Lotus 1-2-3 Macros* (Brady Books, 1988) and Lotus's director of product design for the PC Spreadsheet Division, notes that once a *1-2-3* Release 2.01 macro retrieves another file, it stops running. "Therefore," says Tucker, "a macro can't infect other files in this manner."

In fact, there is no *1-2-3* macro command that modifies another worksheet file on disk. Since the input/output commands in *1-2-3* are geared to ASCII files (WK1 files are binary), it's difficult to see how a macro virus might corrupt another worksheet file. "You just don't have the control," Tucker says, "that's necessary to write a macro virus that changes the data in different worksheets."

ACCOUNTS OF THE VIRUS ARE LIKE SIGHTINGS OF THE LOCH NESS MONSTER. NO ONE HAS SEEN THE BEAST.

Tucker says that even if such a macro were possible, it would be easy to detect. Simply combine the file into a blank worksheet and print the entire contents. Scan the printout for the {OPEN} macro command. If it's not there, you don't have a virus aimed at other files. If it is, it probably works with ASCII files. If it does something you don't understand and you don't know its source, don't use it, he advises.

Tucker cautions, however, that *1-2-3* Release 3 and Release 2.2 have more-powerful macro capabilities than Release 2.01. That includes the ability for a macro to keep running after it retrieves another file. But the new releases also make it easier to examine suspect files by permitting the user to retrieve a file without running the autoexecuting macro. You can then use the Range Search command to look for the {OPEN} macro command or the File commands that you think may delete or modify your files.

In any case, the potential macro virus problem isn't confined to *1-2-3*. Security experts emphasize that any program that allows users to write their own macros could be attacked by a virus. The most popular programs would be the most vulnerable because users commonly exchange the templates that could be carriers of destructive code. Harvey Jeane, vice president of software product research at Ashton-Tate (Torrance, Calif.),

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says he has heard of no one using *dBase* code or macros to build a destructive virus. "Is it possible? Probably," he says. "I haven't given it a lot of thought."

Lotus tightens security

Lotus officials say the rumors are likely being spread by some software producers poised to capitalize on the fear. "If you're in the antivirus business, you want people to be worried about these things to sell your products," says Rattner.

Still, Lotus is taking the rumors seriously. Rattner's principal concern is that the tales might be misunderstood to imply that the product itself is infected. "There's a difference between a virus in a software product and one that attacks a software product," he says.

Rattner says that Lotus's position is that "we're going to acknowledge the potential problem and try to put it into perspective." With Release 3 the company, for the first time, has issued "data-security hints" with documentation. These urge users to be cautious about the sources of their macros.

Security experts, meanwhile, have urged large software publishers to install devices to protect their products from malicious macros. Lotus has no immediate plans for such devices, but it has tightened security around its manufacturing process. When asked what measures Lotus has taken, Rattner declined to elaborate, saying: "The last thing I want to do is challenge someone to beat our security system." *—Andy Maykuth*

MARCEL DUROCHER

WINDOWS 3.0 PROMISES GUTSIER FEATURES

The graphical DOS interface could scoop Presentation Manager.

The prevailing view in the PC business is that at some future point, almost everyone's PC screen will go graphical—with mouse-controlled windows, icons, and bit-mapped displays. The question is, which graphical environment will your PC be using?

Most major software vendors are betting heavily that the answer is Presentation Manager, OS/2's graphical interface. However, at least in the short term, *Microsoft Windows* 3.0, a new release of the graphical environment for DOS due late this year, might be more attractive than Presentation Manager to many PC users.

The two environments differ in some key areas, such as memory management, multitasking, and the file system. However, because applications for the two are developing along different schedules, some observers see a natural progression from *Windows* to OS/2 and Presentation Manager.

The progression may be accelerated if recent reports in the trade press are true. Microsoft and IBM are reportedly working on a way to let Presentation Manager run unmodified *Windows* applications. Although the companies will neither confirm nor deny the reports, the technology is said to involve adding to Presentation Manager a software layer that translates *Windows* calls into Presentation Manager calls. However, this is not expected to happen until late 1990 at the earliest, with OS/2–Presentation Manager version 2.0 for 80386 PCs.

DOS is still strong

The OS/2–Presentation Manager combination is a powerful, flexible operating system that was designed to fix many of DOS's imperfections. But the cost of upgrading systems to run it—and a lack of applications software—have kept it from quickly replacing DOS. In fact, *Computer Reseller News* recently reported that 50 Fortune 500 companies have predicted that in five years, at least half the software they buy will still be DOS-based.

When *Windows* was released in 1985, it also was criticized for a lack of applications, as well as for sluggish performance. However, *Windows* 3.0 boasts a rapidly growing body of applications and many of the features that Presentation Manager now claims, including the ability to address up to 16 megabytes of RAM.

Microsoft declined to comment on specific *Windows* 3.0 features because the product was still not officially announced at press time. Those who have worked with beta copies of the new *Windows* were more forthcoming. "What we have seen so far is impressive," says George Grayson, president of Micrografx, a graphics-software firm in Richardson, Tex.

According to beta testers, *Windows* 3.0 not only gives applications direct access to up to 16 megabytes of memory, it also delivers smoother multitasking, an improved file system, and a more attractive user interface. "*Windows* 3.0 will allow developers to add lots of functionality to applications without cluttering up the user interface," says Grayson. "And it will make it easier to have consistent-looking applications across the DOS and OS/2 platforms."

But the similarities between *Windows* and Presentation Manager are superficial. They may look similar to users, says Mark Zachmann, president of ZSoft (Marietta, Ga.), a graphics-software firm and *Windows* 3.0 beta site, "but Presentation Manager will definitely give you performance

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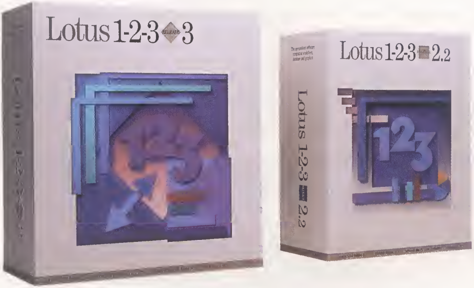

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advantages." This, he explains, is mostly because Presentation Manager is an integral part of the OS/2 operating system, while *Windows* is a graphical extension to DOS and must perform its own memory management.

"Presentation Manager gives you true multitasking," notes Zachmann. Under OS/2, all applications operate concurrently and have simultaneous access to processor time. Moreover, OS/2 can execute multiple processes within a single application, which is called multithreading. Under *Windows*, applications appear to run concurrently, but the foreground program takes precedence. *Windows* polls applications sequentially and queues tasks for the processor. This will be true even of *Windows* applications running under Presentation Manager. Sources say that the new IBM/Microsoft technology won't let *Windows* applications take advantage of OS/2-only features, such as multithreading.

Windows applications on the way

Nonetheless, if enough appealing applications run under *Windows* 3.0, the interface may attract broad user support. And the list of *Windows* applications now or near shipping is impressive. Microsoft itself is expected to release *Windows* applications in the presentation-graphics, word-processing, database, electronic-mail, and project-management categories, although none has been announced. The companies that have announced or shipped *Windows* applications include IBM, Xerox, ZSoft, Micrografx, and Samna Corp.

But major software developers have only so many R&D dollars to spend, and most of those dollars are already committed to applications for OS/2–Presentation Manager. According to a report from International Data Corp. (IDC), a market research firm in Framingham, Mass., only 14% to 17% of the major independent software developers surveyed said they were developing applications for *Windows*, and most of those regard their *Windows* work as an interim step toward Presentation Manager.

Marty Fahey, general manager for *1-2-3/G*, Lotus Development Corp.'s upcoming graphical version of *1-2-3*, says, "The question isn't so much why we aren't into *Windows* as why we are into Presentation Manager." Fahey believes that Presentation Manager's true multi-

MATTHEW CARTER, A CHAMPION OF GOOD TYPOGRAPHY

Bitstream's design chief speaks out on the elements of type style.

Not too long ago, most computer users rarely thought about fonts and typefaces. The reason was simple: There wasn't a lot of choice. Mixing multiple type styles on a page was often next to impossible. But laser printers and page-description languages made it possible to produce documents with several type styles.

Bitstream Inc. (Cambridge, Mass.) began by providing digital type for many software developers and hardware manufacturers, including makers of commercial typesetting equipment. But now the company also designs and sells typefaces to PC users. Its Fontware product line gives PC users access to more than 200 of the typefaces in Bitstream's library of typefaces.

Bitstream fonts work with dot-matrix printers and with laser printers that use Hewlett-Packard's HP PCL printer language or Adobe Systems' PostScript page-description language. Many popular software applications, including *WordPerfect, Lotus Freelance Plus, Ventura Publisher, PageMaker*, and *Microsoft Word*, now either include discount coupons for or come with Bitstream's Fontware Installation Kit and a starter pack of fonts.

Matthew Carter, Bitstream's vice president of design, is responsible for the creation of new type designs and for overall design standards. An expert in typography and digital design, Carter has worked with type for most of his life and has designed such typefaces as Snell Roundhand, Bell Centennial, and ITC Galliard. In May Jon Pepper, a regular contributor to *LOTUS* magazine, asked Carter to comment on the importance and uses of typography in business.

LOTUS: Why should a general business person care about typography?

Carter: All of us have to digest a lot of printed information daily. The idea of a paperless office is obviously nonsense. In fact, we all face more and more paper every day.

Economically speaking, good typography saves paper by allowing the same amount of information to be presented in less space. But more important, a well-designed and well-presented document can save time for the reader. With typographic tools at your command, you can arrange a document so that someone glancing at it can readily see what it's about. Effective typography can draw readers into a document, lead them through it, and help them retain the information that is presented.

Effectiveness is a hard thing to quantify, but experienced typographers know that people respond to a well-designed, typeset document—even a very simple one—much better than to a sloppily prepared document that is hard to read or visually confusing.

SETH RESNICK

tasking and interprocess communications—its ability to allow applications from different vendors to exchange data—make it a more robust environment than *Windows*. Fahey doesn't, however, rule out the possibility that Lotus might eventually write for the *Windows* platform.

Neither does Chuck Middleton, OS/2 development manager for WordPerfect Corp., which has applied to become a beta site for *Windows*. "We are much more interested in *Windows* 3.0 than we were in version 2.0," he says, "but we think Presentation Manager is the future on the PC platform." The company hopes to bring out a Presentation Manager version of *WordPerfect* in early 1990.

Even Said Mohammadioun, president of Samna Corp., developer of the *Windows*-based *Amí* word processor, believes that OS/2–Presentation Manager will eventually be the PC operating system of choice. But he says that in the short run, *Windows* makes a lot of sense for business and professional customers. "Our corporate customers are asking for reasons to switch to OS/2," says Mohammadioun, "and at this point, we find it hard to tell them why they should switch."

'PRESENTATION MANAGER DEFINITELY GIVES YOU PERFORMANCE ADVANTAGES.'

The issue of whether to hold out for Presentation Manager or adopt *Windows* 3.0 as an interim solution is a major question for many corporations. "No one seems to have a clear answer," says Roger Bender, vice president at Citibank and president of the Microcomputer Managers Association of New York.

"*Windows* 3.0 is probably a good investment if you have a '386," says IDC analyst Nancy McSharry, "because you can get used to multitasking and the visual user interface." However, she adds, "going from DOS to *Windows* is a lot of work and money for not much increase in productivity over DOS."

Peter Francis, editor of the newsletter

LOTUS: Are there any studies that confirm the advantages of using type effectively?

Carter: I couldn't direct you to a study that says if you use 12-point Century Schoolbook in your ad you will sell more product, but the results of our focus-group discussions have certainly supported the general proposition that good typography makes sense in business circumstances.

LOTUS: Where do Bitstream's typefaces come from?

Carter: They come from a variety of sources. Some we license from developers or designers, some are in the public domain, and some we design ourselves, though those are in the minority.

LOTUS: Can you do things with digital type design that you couldn't do before?

Carter: Technology hasn't changed type design in a fundamental sense, but some things are a lot easier to do. For example, before digital type design I would have had to draw by hand every character in a new font. Now I can digitize one hand-drawn letter and then reuse some of that information to create closely related letters. There are productivity benefits and economic benefits because fonts are now cheaper to produce and sell. For example, it took about 18 months of work to produce our charter family of six typefaces from scratch, but it's only a two-week job to digitize an existing typeface into our system.

LOTUS: Do today's tools provide more freedom in communications for business users?

Carter: It depends on the corporate culture. Some corporations want a standard format. They want all documents to present information in the same way. Other companies say that different departments or managers want to make different points, so let's allow them some liberty to make their pitch as effectively as they can. On the whole, guidelines aren't a bad idea, but you can't completely police people's use of type.

LOTUS: So you think of type as a personal decision?

Carter: Yes, type is a way in which people can express their personality or point of view or taste, even in humdrum office communications. Choice of type isn't much different from choice of clothing or choice of food.

Most people aren't used to expressing themselves with typography because it has been in the hands of specialists. But no one should feel intimidated. It is perfectly respectable to have your own taste in typefaces. If you like Bookman more than you like Palatino, that's fine.

LOTUS: What do you think about the general use of type today?

Carter: Most people's expectations of what type should be are fairly high. Even the average run of paperbacks and newspapers show a fairly high quality of type. Most typographers agree that how you use type is more important than the choice of the type itself. You can take a perfectly good face and make it unreadable by the way you spec it—if the lines are too long or set too close together, for example. On the other hand, you can take an unpromising face and make it perform well by using it correctly.

LOTUS: How can business users learn about type?

Carter: There are many good books on type and typography, such as *The TypEncyclopedia*, by Frank J. Romano [R. R. Bowker, 1984] and *Graphic Design for the Electronic Age*, by Jan V. White [Xerox Press/Watson Guptill Publications, 1988]. But most people learn best by example. People who are not experts can often pick out what is good and what is bad, without necessarily knowing why. The best way to develop a feel for type is to look at proposals, memos, and newsletters for designs you like and dislike. ■

Andrew Seybold's Outlook on Professional Computing, agrees. "Why should a micro manager take a half step," he asks, "when Presentation Manager applications are finally beginning to show up?"

But corporate users may embrace this half step now if they know they can use their *Windows* applications under Presentation Manager later. As one corporate officer put it, "If OS/2–Presentation Manager had this capability today, we'd move to it now and run all our *Windows* applications on it."

Which way to go?

Microsoft, which stands to profit from both graphical environments, prefers to say simply that a graphical user interface is what is important. "And we have two products—*Windows* and OS/2—that embody our version of it," says Rich Abel, group product manager for *Microsoft Windows*. "We see a continuum of DOS, *Windows*, and OS/2."

As to whether *Windows* 3.0 will win over more developers, Abel says, "We think some developers who dismissed *Windows* initially may revisit it, though no one who has committed to developing for OS/2 has changed his mind."

ZSoft's Zachmann thinks that his company is being pulled in three directions by DOS, *Windows*, and Presentation Manager. He says that right now, "porting a Presentation Manager application to *Windows*, or vice versa, is a lot of work." He adds, "We're spreading our [R&D] resources a little thinner than I would like."

Micrografx's Grayson sympathizes with software developers who are torn about which way to go. "We think *Windows* 3.0 will blow the doors off OS/2 right now," he says, "but a year from now it may be a different situation." *—Jon Pepper*

HOW TO TURN ONE PRINTER INTO TWO OR MORE

Printer-sharing devices offer a low-cost alternative to a LAN.

If you have three PCs in your office and you want them to share a laser printer, you could run out and get a local area network (LAN) for several hundred dollars per connection, not including the cost of a file server. Or you could do what about 250,000 people did last year: buy a printer-sharing device that accomplishes the same thing for $50 per connection or less.

A printer-sharing device consists of a connector box, cabling, and software. Unlike a manual port-switching box, or A-B switch, a printer-sharing device knows what to do when two or more PCs transmit at once. It generally lets the first PC get through, but you can use the software to assign your own priorities. The device then stores data from waiting PCs in a buffer or sends the PC a printer-busy signal.

Analysts are only beginning to follow the market for printer-sharing devices, but Dan Miller, senior industry analyst for the market research firm Dataquest (San Jose, Calif.), estimates that more than 250,000 such devices were sold in 1988. About 80% of them, he adds, are attached to laser or other page printers. "We expect the market to continue to grow," he says, "as users seek to bring down their cost per station."

"My guess," says Angèle Boyd, an analyst with International Data Corp., a market research firm in Framingham, Mass., "is that printer sharing is growing faster than LANs." Of PC printer users recently surveyed by IDC, 8% use a LAN, while 14% use printer-sharing devices.

MARCEL DUROCHER

More than a dozen firms make these devices, in varying degrees of sophistication. At the low end, the $179 SmartPrint Printer Sharing System, from Dresselhaus Computer Products (Rancho Cucamonga, Calif.), can connect four PCs to a printer, but doesn't include any RAM buffering. It does, however, come with a disk-spooler utility. At the high end, Fifth Generation Systems (Baton Rouge, La.) sells a device called the Logical Connection. The $1,095 device provides eight ports and a 1-megabyte buffer. You can attach a maximum of six printers to the unit, but that would leave only two ports for PCs. With some additional software, the device also lets you perform file transfers among the attached computers, making it a close cousin to a LAN.

Between the high end and low end, the buyer faces many choices in a printer-sharing device. For instance, a choice between serial or parallel connections is usually a choice between speed and distance. With a parallel connection, you can transmit between 60,000 and 100,000 bits per second, but usually you cannot transmit across more than about 15 feet of cable. Serial connections can be hundreds or even thousands of feet long, and you can use cheap telephone wire. But transmission speed may be as low as 9,600 bits per second. That can be a real bottleneck if you have several hundred thousand bytes of font definitions to download for each document.

Add memory to the printer

However, you probably don't need much more than a 1-megabyte RAM buffer, says Amnon Even-Kesef, head of ASP Computer Products (Sunnyvale, Calif.), which sells a $495 printer-sharing device called SimpLAN ServerJet. Beyond that, he says, adding RAM to the laser printer is a wiser investment than enlarging the RAM buffer. With enough RAM in the printer, he says, you could download font descriptions once in the morning and print faster for the rest of the day.

You may also want to be able to plug one device into another, piggybacking them to connect more computers and printers. For instance, you could, if you insisted, hook 45 Logical Connections together to let 315 users share a single printer. At that point, though, it might be more constructive to invest in a few more printers. *—Lamont Wood*

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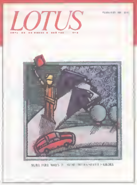

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You've finally mastered the technical challenges of your laser printer. You know all about page-description languages, RAM buffers, and font settings. Now give some thought to the humblest part of the system: the paper.

Most paper mills now make a paper product designed specifically for laser printers. And with about 2.4 million paper-hungry laser printers in use, Merilyn Dunn, a data research analyst with BIS CAP International, a market research firm in Norwell, Mass., estimates that the market for paper used by laser printers will grow 27% per year through 1992.

Smoother is better

A laser printer will work with plain paper or photocopier paper. But for the best possible results, say paper manufacturers, a laser printer requires paper with specially tuned properties. These include smoothness, brightness, cotton content, moisture content, and curling characteristics.

Smoothness, in the lexicon of paper manufacturing, is measured in Sheffield points, where paper that is plate glass smooth is measured at 0 points and construction paper is measured at 300 points. The smoother the paper, the sharper the image and the less chance that dots will get lost in the printing.

Some makes of laser-printer paper are as smooth as 50 Sheffield points. Most bond paper, by contrast, ranges from 175 to 200 points. With most laser-printer paper, one side is smoother than the other. The wrapper will probably have an arrow indicating which side is smoother. In addition, laser-printer paper is brighter, or more reflective, than photocopier paper, which gives the printed image better contrast.

The smoothness and brightness factors are why using typewriter paper and letterhead with a high cotton content can be risky. Regardless of the highly prized rattle, stiffness, and long shelf life of paper with a high cotton content, the cotton fibers often make the paper rougher and less reflective.

You pay a premium for the extra smoothness and brightness of laser-printer paper. At Hammermill Papers (Memphis, Tenn.), for example, the wholesale cost of this paper is about 20% higher than that of photocopier paper. The price difference is even greater at James River Corp. (Richmond, Va.), which sells its laser-printer bond paper for $8.25 per ream (500 sheets)—65% more than its photocopier paper.

The moisture factor

If you need the best-quality output from your laser printer, that added cost may be worthwhile. But not even the finest laser-printer paper is immune from the problems that too high or too low a moisture content can cause. Paper that is too moist will cause the electrostatic charge generated in the printing process to dissipate too quickly. That prevents the toner from adhering properly to the paper and can reduce the darkness of the print dramatically.

Too much or too little moisture can also make paper curl on the sides, which may cause a jam in the printer. Paper companies try to combat curl by control-

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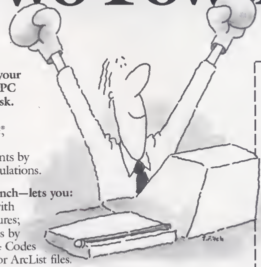

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ling moisture during the manufacturing process, but you must prevent your paper from absorbing or losing moisture once it gets to your office. The experts advise you to use only as much paper as you need for a job and to keep the rest in its wrapper. Most paper wrappers have some sort of a built-in moisture barrier.

If your paper does get damp, try running a few sheets unprinted through the laser printer, then print on them. Be aware, however, that the heat from a laser printer's fusion drum may dry out the paper too much. *—Lamont Wood*

MARCEL DUROCHER

AVOIDING CRASHES AT MEMORY CROSSROADS

There's an agreement in place, but IBM and Microsoft hold out.

You're running the new extended-DOS *1-2-3* Release 3 on an 80386 at work, but it mysteriously locks up at home. You've got 4 megabytes of memory, but you can't access the memory while using program-switching software. As you invoke a pop-up utility over your new database program, it scrambles all the records buffered in memory.

The cause for all of the above may be colliding virtual-control programs, which extend DOS beyond the 640K barrier and are an attractive alternative to OS/2 for many users. Besides saving the cost of the OS/2 upgrade, you can keep your familiar DOS software. And you can run a mix of new and old programs without worrying about OS/2's DOS-compatibility box.

But, say software vendors, unless everyone accepts some rules of the road, there will be a lot of needless program crashes. Getting extra mileage from existing DOS programs means playing some special tricks on DOS and on the newer '386 hardware. Unless every program follows the same rules, or at least keeps other programs aware of what it is doing, the result could be disastrous.

The problem may affect you if you run any of three classes of software that use the special features in '386-based machines, notes Richard M. Smith, president of Phar Lap Software (Cambridge, Mass.). The three classes:

- Software that uses embedded DOS extenders. An example is the program that Rational Systems (Natick, Mass.) is supplying to Lotus Development Corp. for *1-2-3* Release 3. These programs place the bulk of program data and code in the wide-open memory spaces beyond 1 megabyte, with the program code switching into the lower 640K as needed to connect to DOS.
- Programs that adhere to the expanded-memory specification. These applications use memory for data storage that exceeds 1 megabyte.
- Program switchers. An example is *Desqview*, from Quarterdeck Office Systems (Santa Monica, Calif.). These packages let you run more than one standard DOS application at a time, switching parts of programs in and out of 640K memory.

How crashes occur

All of these programs run much of their code in the memory above 1 megabyte, but they also have to communicate with DOS in the memory below 640K, says Gary Saxer, Quarterdeck's director of technical services. Consequently, these programs have to make hardware transitions that DOS never envisioned among the real, protected, and virtual 8086 modes in the '386 chip. If two programs sharing the machine use different modes and leave the system in different states, a crash can occur.

However, with a set of rules and some common procedures for allocating demand for memory exceeding 1 megabyte, several programs can work in harmony. Phar Lap and Quarterdeck earlier agreed to a specification to ensure compatibility between their programs, and they are now offering it to other companies in the industry. This memory-management specification is called the Virtual Control Program Interface (VCPI). Support has come from Lotus, Compaq Computer Corp., Rational Systems, Quadram Corp., and a number of other firms. However, the solution has become a little controversial. Neither Microsoft nor IBM has signed on, although IBM uses Phar Lap's DOS extender in its *Interleaf Publisher* program. There is also no commitment to make *Microsoft Windows/386* or any other product from the pair conform to the VCPI agreement.

VCPI supporters are hopeful, nonetheless. "If we can get the industry lined up to do DOS extension the same way," says Christine O'Connor, general manager of Lotus's Systems Technology Group, "users can buy software from different sources and not have to worry about incompatibilities." *—Steve Rosenthal*

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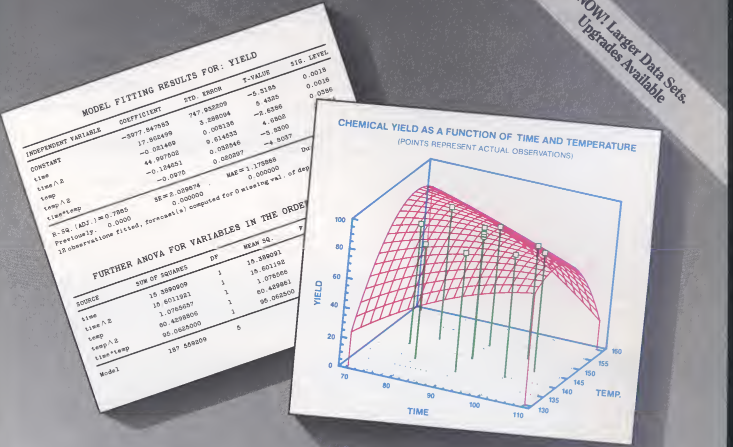

```
            MODEL FITTING RESULTS FOR: YIELD
INDEPENDENT VARIABLE   COEFFICIENT    STD. ERROR    T-VALUE    SIG. LEVEL
CONSTANT               -3977.847583   747.932209    -5.3185    0.0018
time                   17.862499      3.288094      5.4325     0.0016
time∧2                 -0.021469      0.008136      -2.6386    0.0386
temp                   44.997502      9.614533      4.6802
temp∧2                 -0.124651      0.032546      -3.8300
time*temp              -0.0975        0.020297      -4.8037
R-SQ. (ADJ.) = 0.7865    SE= 2.029674    MAE= 1.173868    Du
Previously.    0.0000       0.000000        0.000000
12 observations fitted, forecast(s) computed for 0 missing val. of dep

       FURTHER ANOVA FOR VARIABLES IN THE ORDE
SOURCE        SUM OF SQUARES    DF    MEAN SQ.     F
time          15.3890909        1     15.389091
time∧2        15.6011921        1     15.601192
temp          1.0765657         1     1.076566
temp∧2        60.4298806        1     60.429861
time*temp     95.0625000        1     95.062500
Model         187.559209        5
```

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24-HOUR-A-DAY ELECTRONIC TRADING

At any hour of the day or night, you can download commodity prices on a service such as Dow Jones News/Retrieval, analyze the numbers in a *1-2-3* spreadsheet, and make an investment decision. But if you do all this at midnight, you have to wait until morning before you can call your broker.

That's changing. Starting next month, Globex, an electronic, off-hours market in currencies, futures, and commodities, will open in Chicago. With member exchanges in the United States, Europe, Asia, and Australia, it will be open 24 hours a day. Globex fulfills orders through a process called order matching. You electronically send in a buy or sell order at a specified price. If someone matches your order, there's an instant transaction.

In addition to Globex, the Chicago Board of Trade plans to open its own electronic market. And the New York Stock Exchange may follow suit. When there is enough demand for 24-hour trading in stocks, says Charlotte J. Lee, NYSE vice president for off-hours trading, the NYSE will provide it.

Another step toward all-electronic trading is Instinet Corp., a Reuters subsidiary that operates 14 hours a day as an automated execution service for U.S. and U.K. equities. Instinet conducts business in 14 countries and handles several billion shares in trades per year through more than 1,000 client terminals.

You'll probably never be able to trade securities and commodities directly from your home. After all, the brokers and traders who run the markets don't want to put themselves out of business. But as more exchanges forge worldwide links, brokerage firms will start providing 24-hour service for their insomniac customers and for those home-based traders who want to plug into the Tokyo stock exchange in real time.

—Dana Blankenhorn

PUBLIC FAX

Fax technology is taking off. According to an agreement among telecommunications organizations in North America, Europe, and Australia, by early 1991 airline passengers will have access not only to telephones, but also to onboard fax machines, electronic mail, and computer linkups.

The telecommunications consortium consists of Teleglobe Canada, OTC Ltd. of Australia, France Télécom, and the Paris-based SITA, the Société Internationale de Télécommunications Aéronautiques, which has 330 member airlines. Together, the partners will make worldwide air-to-ground communications available to corporate and commercial aircraft. A plane will communicate via satellite with one of several earth stations, which in turn will provide access to public and private ground networks. At charges of $8 to $10 per minute, the partners expect the market for in-air telecommunications to reach $1 billion by the year 2000.

But if your message isn't a $10-a-minute emergency, you can probably find a public-access fax machine at the airport and use your credit card to send the message before you take off. Faxit Corp. (Mount Laurel, N.J.) was the first of several firms to provide public fax machines. The machines look a bit like public telephones and consist of a facsimile device, a telephone, and a credit card reader. Faxit machines can be found at 20 airports from Boston's Logan to London's Gatwick, as well as in hotels, shopping malls, office buildings, and other likely locations. *—Jennifer Smith*

MUSIC ON-LINE

By next spring some music stores will be carrying their sheet-music inventory on a PC, and musicians will be buying their music on-line.

Each in-store terminal on MusicWriter's (Los Gatos, Calif.) sheet-music distribution network will consist of an IBM-compatible PC, a CD-ROM drive, proprietary add-in board and software, and a laser printer. A CD stores 20,000 songs as data files, and MusicWriter's main computer center downloads new song files at night to the PC's hard disk.

The MusicWriter database is searchable by title, composer, artist, or category, such as rock or classical. After selecting a score, a customer can listen to the first eight bars. If it's not just right, you can change the key, the arrangement, the instrumentation, or the lyric language. MusicWriter will print the finished score as traditional sheet music or save it as a MIDI (musical instrument data interface) file onto a floppy disk or a synthesizer cartridge. A song will cost $3 or so—about the same as today's sheet music.

The system is a real space-saver for music stores, as well as a convenience for shoppers. Some sheet music salespeople are skeptical, however. Don Eubanks, owner of Symmes Music Co. in Atlanta, thinks that obtaining copyright permission may be a problem for MusicWriter. "There are thousands of music publishers," he says, "and many of them have to be willing to go into such a system for it to be worthwhile." *—D. B.*

MARCEL DUROCHER

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REDUCED-MEMORY FREELANCE PLUS

This month Lotus Development Corp. is scheduled to ship *Lotus Freelance Plus* 3.01, a reduced-memory version of *Freelance Plus* 3.0.

The new version offers the same charting, drawing, and presentation capabilities as *Freelance Plus* 3.0. But *Freelance Plus* 3.01 requires only 438K of free memory after DOS is loaded, while *Freelance Plus* 3.0 requires 508K. And if you don't need to create complex charts and drawings, you can run the newer program in 415K by decreasing the amount of memory allocated for these features.

Freelance Plus 3.01 will have a suggested retail price of $495. You may obtain *Freelance Plus* 3.01 for a $20 shipping and handling fee if you now use *Freelance Plus* 3.0 or if you bought *Freelance Plus* Release 2.0 or 2.01 on or after September 6, 1988. If you bought *Freelance Plus* 2.0 or 2.01 before that date, you may upgrade to *Freelance Plus* 3.01 for $100. If you're upgrading from *Freelance* 1.0, the charge is $150. For more information, call 1-800-TRADEUP.

1-2-3 RELEASE 2.2 SHIPS

In late July Lotus Development Corp. shipped *1-2-3* Release 2.2. Here's how to upgrade to the new release.

Lotus will mail an upgrade kit to all registered *1-2-3* users, but you may also upgrade through Lotus Selects and through Lotus-authorized dealers. The upgrade is free if you bought *1-2-3* Release 2.01 on or after September 6, 1988. The free upgrade is available only through Lotus Development Corp., with a dated proof of purchase. If you are eligible for a free upgrade, you must request it by December 31, 1989.

If you bought any version of *1-2-3* before September 6, 1988, you may upgrade to Release 2.2 for $150. However, if you also bought *Always* from Funk Software (Cambridge, Mass.), you are entitled to upgrade to Release 2.2 for $90. In addition, anyone who buys or upgrades to *1-2-3* Release 2.2 may later upgrade to Release 3 for $75.

For more information, call Lotus Selects at 1-800-635-6887, call 1-800-TRADEUP, or contact a Lotus-authorized dealer. Corporate customers may arrange volume upgrades through participating Lotus-authorized dealers or directly through Lotus Development Corp.

Release 2.2 shipped in July.

EDUCATIONAL DISCOUNTS ON LOTUS SOFTWARE

Lotus Development Corp. is offering educational discounts on more software products. The objective, says Mark Flanagan, Lotus vice president of corporate marketing, is to make these products available at affordable prices to students, faculty, and academic administrators. Toward that end, the Douglas Stewart Co. (Madison, Wis.) began to distribute standard editions of these products in early August to college bookstores and educational computer centers throughout the United States. The suggested educational retail prices are as follows:

1-2-3 Release 3	$129
1-2-3 Release 2.2	$ 99
1-2-3 Release 2.01	$ 99
Lotus Freelance Plus 3.0	$ 99
Lotus Agenda 1.01	$ 79
Lotus Manuscript 2.1	$119
Symphony Release 2.0	$149
Lotus Magellan	$ 49

Bookstores and computer centers may offer these prices only to those who show university identification. Bookstores and educational computer centers who would like to become authorized to sell these products should call the Douglas Stewart Co. at 1-800-356-8370. Outlets in Wisconsin should call 1-608-221-1155.

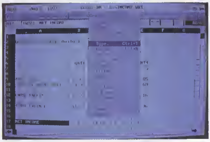
LOTUS SPREADSHEET FOR TANDY DESKMATE

Lotus Development Corp. announced *Lotus Spreadsheet for DeskMate*, which includes a run-time version of Tandy Corp.'s *DeskMate* graphical user interface. The program is similar to *1-2-3* Release 2.01. *Lotus Spreadsheet for DeskMate* is aimed at the small-business and home-office markets, says Lotus President and CEO Jim Manzi. The U.S. Small Business Administration estimates this market at 20 million businesses.

Lotus Spreadsheet for DeskMate uses the WK1 file format and offers integrated spreadsheet, database, and graphics capabilities, plus a mouse-driven graphical format with pull-down menus and dialogue boxes. However, the program does not work with *1-2-3* add-ins or with expanded memory, nor does it include a macro language. Its files are compatible with *Symphony* and all releases of *1-2-3*, and the program works with other *DeskMate* applications, such as *Memory Mate* from Broderbund Software (San Rafael, Calif.) and *Q&A Write* from Symantec Corp. (Cupertino, Calif.).

"*Lotus Spreadsheet for DeskMate* promises to be one of the most popular *DeskMate* applications," says John V. Roach, Tandy's chairman and CEO.

The product is currently in beta testing and is scheduled for release in the fourth quarter of this year. It will carry a suggested retail price of $219.95 and will be distributed through the 7,000 participating Radio Shack stores and dealers in the United States. The program requires 512K of RAM and will operate on all Tandy and other IBM-compatible PCs under DOS 3.2 or higher. Lotus will provide support, service, and a customer-assurance plan.



Lotus Spreadsheet for DeskMate **uses Tandy's** ***DeskMate*** **graphical interface with pull-down menus and dialogue boxes.**

MAGELLAN VIEWER TOOLKIT AVAILABLE

The *Magellan* Viewer Toolkit is now available. With the Toolkit, third-party developers can create "viewers" for *Magellan*, Lotus's text search and retrieval utility. A viewer provides a link between *Magellan* and DOS-based files so that *Magellan* can, for example, display the content of a file exactly as it appears in its original context.

Magellan was shipped in April with viewers for 10 popular software applications. "But the types of viewers that can be developed are almost limitless," says *Magellan* developer Bill Gross. Viewers can also perform complex functions, such as checking spelling and grammar, creating forms for specialized documents, or analyzing numerical relationships in spreadsheets.

The Toolkit includes documentation on how to design, test, and debug a viewer, plus some sample code. Lotus will maintain a list of available viewers and publish it in the Lotus Products Enhancement Guide. In addition, Lotus will forward user requests to the appropriate third-party vendor.

The *Magellan* Viewer Toolkit is available directly from Lotus for $150. In addition to the Toolkit, developers need *Magellan* Release 1.0, DOS 2.0 or higher (DOS 3.0 or higher is recommended), and Microsoft C version 5.1 with the Microsoft linker or compatible. For more information, call 1-800-343-5414.

LOTUS/SUN ALLIANCE

Sun Microsystems and Lotus Development Corp. have signed a development and marketing agreement that calls for Lotus to develop applications for Sun's three Unix-based computing platforms.

These platforms include the 80386-based Sun 386i; the Sun-3 line, which uses Motorola's M68000 processor; and Sun workstations that use the Open Look graphical interface and are powered by the Sparc processor, which is a RISC (reduced instruction set computing) chip. The financial terms of the agreement and specific product timetables were not disclosed. ■

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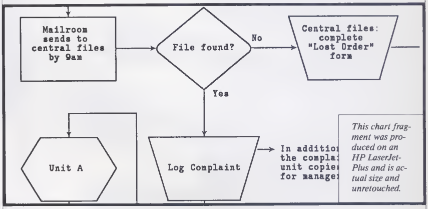
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Of course, the experts aren't the only ones who favor Harvard Graphics. In fact, with its growing popularity, Harvard Graphics has become the number-one selling business graphics software.

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START HERE

1-2-3: DATABASE

Having learned the basics of *1-2-3*'s spreadsheet, you are ready to pursue database management.

BY DANIEL GASTEIGER

Database is a fancy word for a very simple thing: a collection of information. Most of us use databases every day. A dictionary is a database of words and their meanings. The telephone directory is a database of people's names, phone numbers, and addresses.

While many of the databases we use each day are fairly static in size and content, other databases grow and change to accommodate new information. For example, your dictionary doesn't change at all from day to day, but your address book changes as you meet new people or as the people you know change residences or jobs.

1-2-3 provides tools you can use to manage collections of information. When you enter information into the worksheet in a specific arrangement, you can quickly sort it into alphabetic and numeric order. You can also have *1-2-3* find information about a particular item or items far more quickly than you could find the information yourself—especially when it's buried within a list of hundreds or thousands of items.

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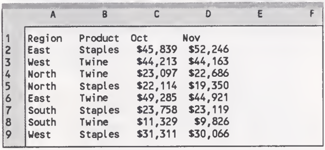

	A	B	C	D	E	F
1	Region	Product	Oct	Nov		
2	East	Staples	$45,839	$52,246		
3	West	Twine	$44,213	$44,163		
4	North	Twine	$23,097	$22,686		
5	North	Staples	$22,114	$19,350		
6	East	Twine	$49,285	$44,921		
7	South	Staples	$23,758	$23,119		
8	South	Twine	$11,329	$9,826		
9	West	Staples	$31,311	$30,066		

This database stores the monthly revenue data on the sales of two products in four sales territories. Notice that each column of the database has a name: *Region*, *Product*, *Oct*, and *Nov*. These names identify the columns' contents and are important for some of the database-maintenance tasks we'll perform in later installments of "Start Here."

These column names are database field names, or field headers. In a *1-2-3* database, each category of information falls within a single field. In an address database, for example, you might store people's first names in one field, their last names in a second, their street addresses in a third, and so on.

Each row of data in a *1-2-3* database contains a single database record, which is all the information about a specific item or person. In this database, each record contains information about a product and the region in which it's sold. For example, the database's first record is of the sales of staples in the eastern region. The second record is of the sales of twine in the western region.

Field and *record* are the most important terms to learn when you're working with databases in *1-2-3*. Generally, you'll be rearranging records by sorting them into alphabetic or numeric order, or you'll be searching for a specific record or records. When you find a record of interest, you'll most likely wish to examine information stored in a particular field of that record.

The terminology aside, let's look at how to sort a database.

ENTER THE DATA

To see how *1-2-3* manages data, you need some data to manage. Entering the data will provide a review for those who have been following this column from its inception. To follow the discussion, enter the labels and values shown in the previous figure.

Remember that you shouldn't enter the dollar signs and commas that appear in each of the numbers in columns C and D. Enter only the values of the dollar amounts shown. Once you've entered the labels and values, use the Range Format command to assign a currency format with no decimal places to range C2..D9. To do this, press slash, select Range Format Currency, and enter 0. Then type C2..D9 and press Return. The dollar signs and commas will appear instantly. Now save the file.

That's all there is to creating a *1-2-3* database. Simply put one record in each row, making sure that the field entries fall in the correct columns. Now that a database

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Daniel Gasteiger is a contributing editor to LOTUS *and president of the software firm Tenet Educational.*

resides in the worksheet, you can use any of the familiar menu commands and function keys to edit the data, format it, and move it around, as needed.

PUTTING IT ALL IN ORDER

This is a simple little database. If you want to examine the revenue generated in November by sales of twine in the eastern region, you can scan the information quickly and find the amount $44,921. But imagine scanning a database to find just one of five or six hundred records. Not a pleasant thought.

One way to simplify the task would be to alphabetize the records by the entries in the *Region* field. At least then you'd be able to find all the eastern-region entries quickly, and you'd have to scan fewer records overall.

To alphabetize a *1-2-3* database, you must use the menus to identify the database's Data range. To do this, select /Data Sort Data-Range. *1-2-3* prompts you to enter the Data range and offers the address of the current cell as the default option. You're going to sort the entries in range A2..D9.

To select the Data range, you can use one of two methods: You can move the cell pointer to cell A2, press the period key, press the RightArrow key three times, press DownArrow seven times, and press Return. Or you can type A2..D9 and press Return.

Having identified what data you wish to sort, you must tell *1-2-3* which column to use as the sort index—in other words, which column should end up in alphabetic or numeric order. In this case, you're alphabetizing the *Region* column.

To indicate this to *1-2-3*, first select Primary-Key from the Sort menu. *1-2-3* prompts you to identify the primary sort key. Move the cell pointer to any cell in column A, or simply type the address of a cell in that column. Then press Return. *1-2-3* prompts you to enter a sort order, which determines whether the program puts the database into ascending (alphabetic) or descending (reverse alphabetic) order. Type A for ascending and press Return.

Finally, to sort the database, select Go from the menu. Instantly, the records regroup with the eastern-region entries first, the northern region second, the southern region third, and the western region last. You can quickly find the twine sales for November within the eastern region by scanning only the records for that region.

SORT SOME MORE

Suppose that you wish to arrange the data in a different order. For example, you're interested in the product that generated the least revenue in October. Rather than alphabetizing by sales region, you might select the *Oct* field, sorting the records in ascending order.

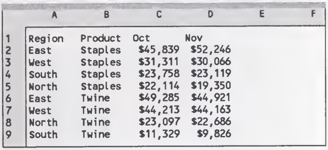
To do this, select /Data Sort. You don't need to assign a Data range because *1-2-3* remembers the range that you assigned earlier. Check this by selecting Data-Range. *1-2-3* identifies range A2..D9 as the default range. Press Return to accept the default.

Select Primary-Key and override the existing key assignment by moving the pointer to a cell in column C and pressing Return. Press Return again to accept an ascending sort order, then select Go. *1-2-3* rearranges the data, and you instantly see that twine generated the lowest of the revenues in October.

Try one more exercise. It might someday prove useful to examine all the twine sales and all the staples sales separately. What's more, it would be nice to see the region that generated the most revenue in October at the top of each list.

To do this, you must assign two sort keys. The first sort key will be the *Product* field. When you alphabetize by product, all the staples sales will move to the top of the list, and the twine sales will move to the bottom. The second sort key will be the *Oct* field. The second sort key serves as a "tiebreaker" for all entries that are identical in the first sort-key field. Therefore, with the *Oct* column as the second sort key, all the staples entries will be in descending order by October's revenues, as will all the twine entries.

Select /Data Sort Primary-Key and indicate any cell in column B as the primary sort key. Press Return to accept ascending order. Then select Secondary-Key and indicate any cell in column C as the secondary sort key. Press Return to accept descending order. Select Go, and the records will appear as shown in the following illustration:



	A	B	C	D	E	F
1	Region	Product	Oct	Nov		
2	East	Staples	$45,839	$52,246		
3	West	Staples	$31,311	$30,066		
4	South	Staples	$23,758	$23,119		
5	North	Staples	$22,114	$19,350		
6	East	Twine	$49,285	$44,921		
7	West	Twine	$44,213	$44,163		
8	North	Twine	$23,097	$22,686		
9	South	Twine	$11,329	$9,826		

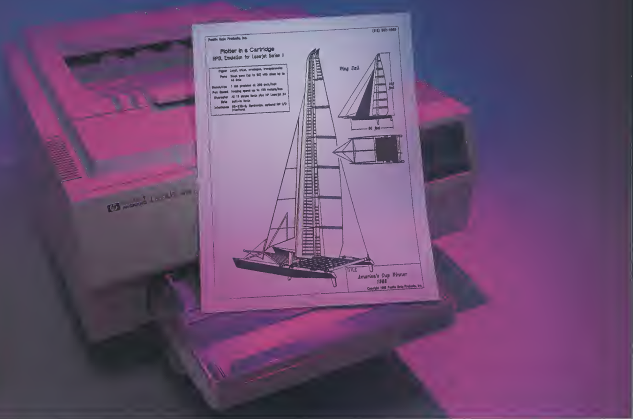
ON YOUR OWN

Sorting database entries is as easy as deciding the order that you wish to establish in your worksheet. Do you want to alphabetize by region or by product name? Do you want to see which product generates the most revenue in a particular region?

Assign some sort keys of your own choosing, and before you select Go, predict what order the database will assume. Then create your own database and see how powerful the Data Sort command really is. You can enter hundreds of records in any order that's convenient, then alphabetize them when the urge hits you.

We won't stop here. Sorting is convenient, but it's not the only way to benefit from having a database in *1-2-3*. In future columns we'll discuss ways to find specific records without having to scan the database at all. We'll also learn how to copy specific records from anywhere in the database to a separate area of the worksheet. ■

The Wait is Over.



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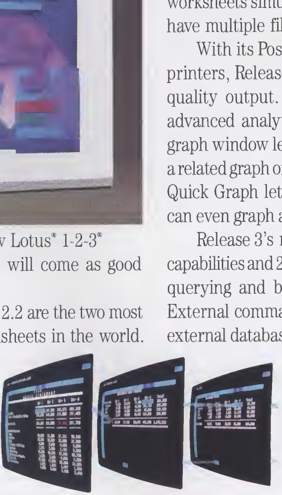

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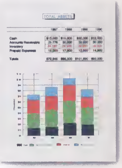
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1-2-3 MACROS

HOW TO BUILD A VERSATILE TOOLBOX

This structured set of macros can help you solve advanced business problems. The {DEFINE} command is the secret.

BY NICK DELONAS

Suppose your company intends to invest in an oil-exploration venture that involves exploratory drilling at 21 locations. Let's say that the probability of finding a profitable reserve at any one site is 7% and is independent of the success or failure of drilling attempts at the other sites. You need to know the probability of *at least one* success among the 21 attempts.

We'll show you how to build a template that calculates this number and handles some related questions about other probabilities your employer might request. When you finish creating the template, you'll have a good start on a toolbox suitable for tackling a variety of business problems.

To calculate probabilities, you use a binomial distribution. The equation is:

$$P(X=x|n,p)=\left[\frac{n!}{x!(n-x)!}\right]p^x(1-p)^{n-x}$$

In this equation x is the number of successes in a sample, n is the sample size, and p is the probability of success. $P(X=x|n,p)$ is the notation for a binomial distribution. This equation is easy to solve with a sheet of paper and a good hand-held calculator. Incorporating it into a spreadsheet, however, is not so easy.

If you've ever faced a complex problem like this or simply would like to solve binomial distribution problems using *1-2-3*, follow along. You may be surprised at how easy it is to tackle a complex problem if you break it down into its parts.

BUILD A STRUCTURED TOOLBOX

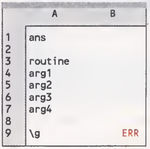
You might recognize the expression inside the brackets of the equation. It's the function for determining how many combinations, or arrangements, of x successes can occur in n observations. This function is difficult to set up in a worksheet because it contains factorials.

You may recall that the notation for n factorial is $n!$, which is defined as follows:

$$n!=n(n-1)\ldots(1)$$

If you start by creating a macro that solves for a factorial, the problem is manageable; it's not difficult to write a looping macro that will work. But before you start coding, remember that this routine will be used by other macro routines. The {DEFINE} command helps you design a structured macro routine that can be used by other macro routines.

Enter labels as shown in the figure below in a blank worksheet, omitting for now the text shown in red.



	A	B
1	ans	
2		
3	routine	
4	arg1	
5	arg2	
6	arg3	
7	arg4	
8		
9	\g	ERR

Press slash, select Worksheet Global Column-Width, and enter 10.

Position the cell pointer in cell A1 and select /Range Name Labels Right. Indicate range A1..A9 and press Return. You've just assigned the labels in column A as range names for the adjacent cells in column B.

In cell B9 enter the following formula, which will initially return ERR:

```
+“{”&routine&@IF(@CELL(“type”,!arg1)=“v”,
“ ”&@STRING(!arg1,7)&@IF(@CELL(“type”,!arg2)=
“v”,“,”&@STRING(!arg2,7)&@IF(@CELL
(“type”,!arg3)=“v”,“,”&@STRING(B6,7)&
@IF(@CELL(“type”,!arg4)=“v”,“,”&
@STRING(!arg4,7),“”),“”),“”),“”)&“}~”
```

Enter *factorial* in cell B3 and the value 3 in cell B4. The formula in cell B9 returns {factorial 3.0000000}~. Now enter *binomial* in cell B3, 1 in cell B4, 21 in cell B5, and .21 in cell B6. The formula in B9 returns {binomial 1.0000000,21.0000000,0.2100000}~. This illustrates how the string formula in cell B9 converts your entries in range B3..B7 to the format of a macro routine call that has arguments.

The formula will launch the macro routines you have yet to create. In cell B3 enter the name of any routine, and in range B4..B7 enter any corresponding arguments. You would then run the routine by holding down the MACRO key (Alt on most computers) and pressing G. This arrangement will launch any macro routine you create, as long as it doesn't require more than four arguments.

Each such macro routine will put its answer in the cell named *ans* (cell B1). Each macro will get all its inputs from the string formula in cell B9 (the macro named \g). Setting up this input area before you start to write any macros forces a structure onto the macro toolbox that you're creating.

WRITE THE FACTORIAL ROUTINE

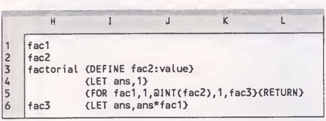
Erase range B3..B6. Enter *factorial* once again in cell B3 and the value 7 in cell B4.

The routine named *factorial* must accept arguments from other macros. So the first command in the routine must be {DEFINE}, which has the following syntax:

{DEFINE *location1:type1*[*,location2:type2,...*]}

Arguments inside the square brackets are optional.

{DEFINE} takes each argument from the calling macro and stores that argument in a specified location as either a string or a value. To see how this works, enter labels as shown in the following figure:



```
        H          I          J          K          L

1   fac1
2   fac2
3   factorial {DEFINE fac2:value}
4             {LET ans,1}
5             {FOR fac1,1,@INT(fac2),1,fac3}{RETURN}
6   fac3      {LET ans,ans*fac1}
```

Use the Range Name Labels Right command to assign the labels in column H as range names for the adjacent cells in column I. Press the Home key. You can now calculate the factorial of 7.

Run the \g macro by pressing MACRO-G. The routine named *factorial* calculates the factorial of 7 and enters the answer, 5040, in the cell named *ans*. If you don't get this answer, check for errors. Here's how the macro works:

First, the string formula in the macro named \g returns {factorial 7.0000000}~ and calls the routine named *factorial*.

{DEFINE fac2:value} takes the single argument from the calling routine and stores it as a value in the cell named *fac2*.

{LET ans,1} sets the value in *ans* to 1 to prepare for the calculation of the factorial. Since *ans* is, by design, the destination for every routine's answer, each routine can use *ans* to hold interim calculation results. This cuts down on the required number of named ranges.

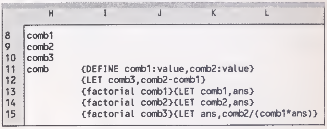
{FOR fac1,1,@INT(fac2),1,fac3}{RETURN} controls a macro routine that *1-2-3* processes for a specified number of times. The loop starts by placing the second argument, 1, in the counter cell named in the first argument, *fac1*. Each time *fac3* is processed, the value in *fac1* is increased or decreased by adding the value in the fourth argument. In this case, each loop increases the value in *fac1* by 1. When the value in *fac1* exceeds the value in the third argument, the macro stops looping. In this case, since the third argument, @INT(*fac2*), equals 7, *fac3* is run seven times. After the {FOR} loop is completed, the macro returns control to the calling routine. Here's what the routine named *fac3* does:

{LET ans,ans∗fac1} enters the product of *ans* and *fac1* in *ans*. In this case, *ans* ends up equaling 1∗2∗3∗4∗5∗6∗7, since it's multiplied by each successively higher integer as the {FOR} loop progresses.

Note that all the named ranges associated with the routine named *factorial* have names similar to the word *factorial* (*fac1*, *fac2*, and *fac3*). Use this convention for every routine you create in this toolbox.

CONTINUE CREATING TOOLS

Now create the routine for calculating combinations—the portion of the equation inside the brackets—by entering labels as shown in the following figure:



```
        H          I          J          K          L

8   comb1
9   comb2
10  comb3
11  comb      {DEFINE comb1:value,comb2:value}
12            {LET comb3,comb2-comb1}
13            {factorial comb1}{LET comb1,ans}
14            {factorial comb2}{LET comb2,ans}
15            {factorial comb3}{LET ans,comb2/(comb1*ans)}
```

Use the Range Name Labels Right command to assign the labels in range H8..H11 as range names for the adjacent cells in column I. Press the Home key.

The routine named *comb* calculates the number of ways to select *X* successes out of *n* trials. It requires two arguments: *X* and *n*, respectively. To determine, for example, the number of possible combinations of 2 successful drilling efforts and 19 failures, enter *comb* in cell B3, 2 in cell B4, 21 in cell B5, and press MACRO-G. The resulting value in *ans* should be 210.

Here's how it works:

{DEFINE comb1:value,comb2:value} enters the first argument as a value in *comb1* and the second argument as a value in *comb2*.

{LET comb3,comb2 – comb1} subtracts the value in *comb1* from the value in *comb2* and enters the result in *comb3*. Note again that named cells used by the routine named *comb* are located near the routine and are given names that identify their association with it.

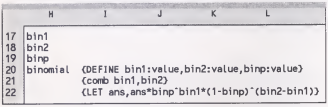
{factorial comb1}{LET comb1,ans} calls the routine named *factorial* and uses *comb1* as the argument. The macro then takes the value returned by *factorial* and copies it from *ans* to *comb1*. Now you can see the benefit of structuring your toolbox as you have. Every routine you create is available to all other routines. You simply call a routine with the necessary arguments and then retrieve the result from *ans*.

{factorial comb2}{LET comb2,ans} calls the routine named *factorial*, uses *comb2* as the argument, and copies the result from *ans* to *comb2*.

{factorial comb3}{LET ans,comb2/(comb1∗ans)} calls the routine named *factorial* and uses *comb3* as the argument. The macro then divides the value in *comb2* by the product of *comb2* and *ans*, and enters the result in *ans*.

ON TO BINOMIAL CALCULATIONS

With the routine named *comb* at your disposal, creating the routine named *binomial* is relatively simple. Enter labels as shown in the following figure:



```
          H           I           J          K          L

17  bin1
18  bin2
19  binp
20  binomial  {DEFINE bin1:value,bin2:value,binp:value}
21            {comb bin1,bin2}
22            {LET ans,ans*binp^bin1*(1-binp)^(bin2-bin1)}
```

Use the Range Name Labels Right command to assign the labels in range H17..H20 as range names for the adjacent cells in column I. Press the Home key.

Now refer to the first equation shown on page 32. The routine uses the first argument in the {DEFINE} command as x, the second argument as n, and the third argument as p. Enter *binomial* in cell B3, 1 in cell B4, 21 in cell B5, and .07 in cell B6. Press MACRO-G.

The value 0.3443311 appears in cell B1. So the binomial routine tells us that the probability of exactly one success is about 34%.

Here's how it works:

{DEFINE **bin1:value,bin2:value,binp:value**} stores the arguments of the calling macro as values in *bin1*, *bin2*, and *binp*, respectively.

{comb **bin1,bin2**} calls the routine named *comb* and uses the values in *bin1* and *bin2* as arguments.

{LET ans,ans*binp^bin1*(1−binp)^(bin2−bin1)} enters the final answer in *ans*. This formula follows the logic of the binomial equation. The result of the portion of the equation inside the brackets is already in *ans*. It was calculated by *comb*. The rest of the formula is easy to follow by looking again at the original equation. The cell named *ans* contains the portion of the equation in brackets, *binp* is p, *bin1* is x, and *bin2* is n.

ARE WE THERE?

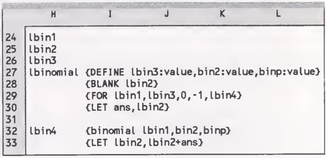
The probability of exactly one success isn't what you were looking for. You want to know the probability of *at least* one success. That requires solving the following equation, for which you need two more routines:

$$P(X \geqslant x | n,p) = 1 - \sum_{i=0}^{x-1} \left[\frac{n!}{i!(n-i)!} \right] p^i (1-p)^{n-i}$$

The routine in the figure at the top of the next column calculates the so-called left tail of a binomial distribution.

Enter the labels as shown and use the Range Name Labels Right command to assign the labels in range H24..H32 as the range names for the adjacent cells in column I. Press the Home key.

This is a very useful routine. If, for example, you want to know the probability of *at most* two successes (less than three successes), you can use this routine. Enter *lbinomial* in cell B3, enter 2 in cell B4, and leave the other arguments as they are. Press MACRO-G.



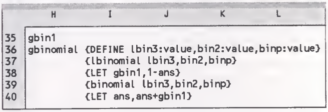
```
          H           I           J          K          L

24  lbin1
25  lbin2
26  lbin3
27  lbinomial {DEFINE lbin3:value,bin2:value,binp:value}
28            {BLANK lbin2}
29            {FOR lbin1,lbin3,0,-1,lbin4}
30            {LET ans,lbin2}
31
32  lbin4     {binomial lbin1,bin2,binp}
33            {LET lbin2,lbin2+ans}
```

The value in *ans* is 0.8213472. So the probability that there will be at most two successes is about 82%.

The routine named *lbinomial* uses a {FOR} loop to call the routine named *binomial* once for every integer 0 to x. The results of each *binomial* calculation are summed in *lbin2*. When the {FOR} loop is finished, the value in *lbin2* is copied to *ans*.

FINALLY, THE ANSWER

To solve the original problem of calculating the probability of at least one successful drilling effort, we need another routine. Enter labels as shown in the figure below:



```
          H           I           J          K          L

35  gbin1
36  gbinomial {DEFINE lbin3:value,bin2:value,binp:value}
37            {lbinomial lbin3,bin2,binp}
38            {LET gbin1,1-ans}
39            {binomial lbin3,bin2,binp}
40            {LET ans,ans+gbin1}
```

Use the Range Name Labels Right command to assign the labels in range H35..H36 as range names for the adjacent cells in column I. Press the Home key.

We named the routine *gbinomial* to signify the right tail of the binomial distribution. Enter *gbinomial* in cell B3, 1 in cell B4, and leave the other arguments as they are. Press MACRO-G.

The value in *ans*, 0.7821578, indicates about a 78% probability of at least one successful drilling attempt. We'll leave it up to you to figure out the logic of this routine. Do note, however, that *gbinomial* calls *lbinomial*, which in turn calls *binomial*, which in turn calls *comb*, which in turn calls *factorial*.

Use this macro toolbox as the start for your custom problem solver. Every routine is available to new routines you create. And if you follow the structure carefully, every new routine you write will, in turn, be available to future routines. To keep track of your routines, list their names and arguments somewhere in the worksheet. Then you'll never have to reexamine a routine's macro code once you've debugged it.

(For Macro Letters, see page 36.)

LOTUS *thanks Daniel Weiner, assistant professor of mathematics at Boston University, for his review of the mathematics in this article.*

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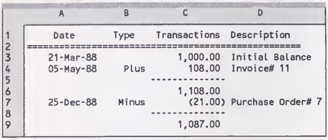
MACRO LETTERS

KEEPING TRACK OF CASH FLOWS

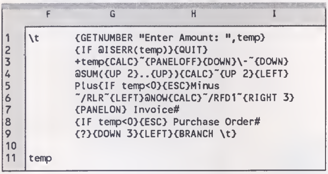
I use *1-2-3* Release 2.01 to keep running totals of cash inflows and outflows for my small business. Here's how I have the template set up:



```
         A             B            C            D

1      Date          Type    Transactions  Description
2  ==================================================
3     21-Mar-88                    1,000.00  Initial Balance
4     05-May-88       Plus           108.00  Invoice# 11
5                              -------------
6                                  1,108.00
7     25-Dec-88      Minus           (21.00) Purchase Order# 7
8                              -------------
9                                  1,087.00
```

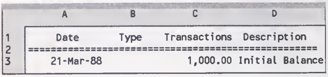
To make the data-entry process easier, I developed a macro that automatically adds the date, transaction type, and description labels. It also creates a summation line and calculates the new cash balance.



```
      F          G                H                 I

1   \t       {GETNUMBER "Enter Amount: ",temp}
2            {IF @ISERR(temp)}{QUIT}
3            +temp{CALC}~{PANELOFF}{DOWN}\-~{DOWN}
4            @SUM({UP 2}..{UP}){CALC}~{UP 2}{LEFT}
5            Plus{IF temp<0}{ESC}Minus
6            ~/RLR~{LEFT}@NOW{CALC}~/RFD1~{RIGHT 3}
7            {PANELON} Invoice#
8            {IF temp<0}{ESC} Purchase Order#
9            {?}{DOWN 3}{LEFT}{BRANCH \t}
10
11  temp
```

To build this model, enter labels as shown in range F1..G11. Remember to type an apostrophe before entering the labels in cells G3 and G4. Use the Range Name Labels Right command to assign the labels in column F as names for the adjacent cells in column G. Then enter the following:



```
          A             B            C            D

1       Date          Type    Transactions  Description
2  =====================================================
3     21-Mar-88                      1,000.00 Initial Balance
```

All entries are labels except cell A3, which contains an @DATE formula, and cell C3, which contains a value. Set the Global Column-Width to 14. Set the width of column B to 9. Use the Range Format Date 1 command to format cell A3. Set the format for cell C3 for Comma 2. Note that the label in cell D3 starts with a blank space. Press the Spacebar once before entering it.

To run the macro, position the pointer in cell C4, hold down the MACRO key (Alt on most computers), and press T. Enter a number as prompted. Use positive numbers for cash inflows and negative numbers for outflows.

Depending on whether the number you've entered is positive or negative, the macro will prompt you to finish entering an appropriate transaction description. You can provide an invoice or purchase-order number as prompted, or press the Escape key and enter your own description for exceptional transactions. To stop the macro, hold down the Control key, press Break, then press Escape.

Here's how it works:

{GETNUMBER "Enter Amount: ",temp} prompts you for a transaction amount and stores the number you enter in *temp*.

{IF @ISERR(temp)}{QUIT} checks to see if *temp* contains an error. If it does, the macro run stops. This would be the case if you entered a label or pressed Return without making an entry. The purpose of this line is to let you stop the data-entry procedure easily.

+temp{CALC}~{PANELOFF}{DOWN}\–~{DOWN} copies the value in *temp* to the current cell. The macro shuts the control-panel display off and moves the pointer down one row. It then creates a dashed summation line and moves the pointer down another row.

@SUM({UP 2}..{UP}){CALC}~{UP 2}{LEFT} adds the transaction amount to the previous balance and enters the result in the current cell. The macro then moves the pointer up two rows and one column to the left.

Plus{IF temp<0}{ESC}Minus types *Plus* if the transaction is a cash inflow and *Minus* if the transaction is a cash outflow.

~/RLR~{LEFT}@NOW{CALC}~/RFD1~{RIGHT 3} presses Return and formats the current cell using a Range Label Right command. The macro moves the pointer to the left and enters the current date. It then formats the cell using the Range Format Date 1 command and moves the pointer three columns to the right.

{PANELON} Invoice# turns the control-panel display on and types *Invoice#*. Note that this line ends with a space character.

{IF temp<0}{ESC} Purchase Order# checks to see if the value in *temp* is a negative number. If it is, the macro presses the Escape key to erase *Invoice#* and types *Purchase Order#*. Again, this line ends with a space character.

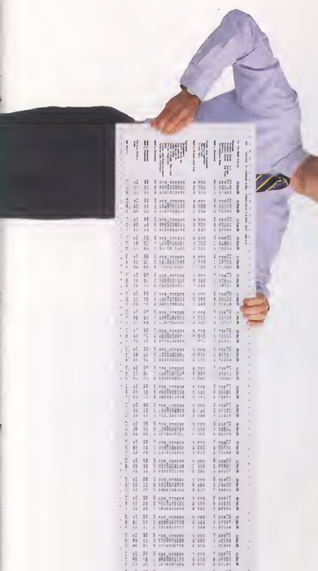
{?}{DOWN 3}{LEFT}{BRANCH \t} pauses for you to finish the transaction description. When you press Return, the macro enters the description in the current cell. It then moves the pointer down three rows and to the left before looping to the top to restart the routine.

Mark Buonagurio
Yonkers, N.Y.

Send Us Your Macros

If you have questions about macros, send them to us. If you have a favorite macro technique, we'd like to see it. If we use your letter in a column, we'll send you $25. Write to: Macros Editor, LOTUS *Magazine, P.O. Box 9123, Cambridge, MA 02139–9123.*

Funk Software continues to forge Sideways.



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CIRCLE 111 ON READER SERVICE CARD

MACRO BASICS

A FASTER WAY TO COPY

Learn how to use macros. Try the speedy {LET} command, which is 40 times faster than the Copy command.

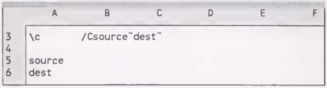
BY NICK DELONAS

Imagine that you need to analyze data that you download weekly from the corporate computer. Since the mainframe's data organization doesn't suit your needs, you spend a morning copying hundreds of figures into an appropriate format. Lunchtime rolls around, and you feel as though you haven't accomplished anything.

And you are right. You are wasting your mornings. You should save your brainpower for reasoning and creativity and let your computer do the grunt work. Not only can *1-2-3* copy for you, it can do it faster. All it needs is a set of instructions—that is, a macro.

Once you've created a macro, you store it in a range in the worksheet, assigning a name to that range. You then tell *1-2-3* to process these instructions by holding down the MACRO key (Alt on most computers) and pressing the letter that corresponds to the range name you gave the macro. This may sound complicated, but in fact it's easy to create a useful macro.

Build the macro depicted in the following figure:



```
      A         B          C         D         E         F
3  \c        /Csource~dest~
4
5  source
6  dest
```

Start by entering all the labels as shown. Remember to begin the labels in cells A3 and B3 with an apostrophe.

Move the cell pointer to cell A3. Press slash and select Range Name Labels Right. Indicate range A3..A6 and press Return. This command assigns the labels in column A as range names for the adjacent cells in column B. You can use these range names, which serve as aliases for cells B3, B5, and B6, as if they were cell addresses. For example, press the GOTO key (F5 on most computers), type *dest*, and press Return. *1-2-3* moves the cell pointer to cell B6.

Move the cell pointer to cell B5 and enter the value 21. Now press slash, select Copy, type *source*, and press the Return key. When prompted for a range to copy to, enter *dest* and press Return. *1-2-3* copies the value in cell B5 to cell B6.

Use the Range Erase command to erase this value from cell B6.

Now look at the label in cell B3. This is a macro that tells *1-2-3* to copy the contents of the range named *source* (cell B5) to the range named *dest* (cell B6). The tilde (~) represents the Return key. As you can see, the macro uses the same keystrokes that you do. It presses slash, selects Copy by pressing C, enters *source*, and presses Return. It then enters *dest* and presses Return. To run this macro, hold down the MACRO key and press C. The macro copies the value from cell B5 to cell B6.

EVEN FASTER COPYING

Undoubtedly, using a macro with the Copy command is faster than copying manually, but there is an even faster technique. The {LET} command is a macro keyword that enters a value or a string into a specified cell 40 times faster than the Copy command does. If you have hundreds of figures to copy, the speed increase could mean waiting three minutes instead of two hours.

To see how the {LET} command works, first save the worksheet you created with the file name LET1. Now change the contents of cell B3 to the label shown in cell B3 of the figure at the top of the next page.

Here, the {LET} command replaces the macro's former keystroke calls to the Copy command. The macro has the syntax {LET location,number or string}. In this case, {LET}

JOHN DYKES

	A	B	C	D	E	F
3	\c	{LET dest,source}~				
4						
5	source	21				
6	dest	21				

will copy the value or string from *source* to *dest*.

Erase cell B6. Hold down the MACRO key and press C. The new macro copies the value in cell B5 to cell B6 as before, only faster.

Save the new macro with the file name LET2 and then retrieve the file LET1.

To see how much faster the {LET} macro really is, add labels as shown in range A1..B1 of the following figure:

	A	B	C	D	E	F
1	\f	{FOR source,1,108,1,\c}				
2						
3	\c	/Csource~dest~				
4						
5	source	21				
6	dest					

Use the Range Name Labels Right command to assign the label in cell A1 as a range name for the adjacent label in cell B1.

You've just created the \f macro, which uses the advanced {FOR} command. Don't worry about how the {FOR} command works. Suffice it to say that the \f macro runs the \c macro 108 times consecutively and counts the repetitions in the *source* cell. The \c macro copies this changing value from *source* to *dest*. Press MACRO-F and note how long it takes to process the \c macro 108 times. It took 42 seconds on our IBM PC AT.

Save the worksheet under the file name LET3. Now change the label in cell B3 to the {LET} command, as shown in the next figure:

	A	B	C	D	E	F
1	\f	{FOR source,1,108,1,\c}~				
2						
3	\c	{LET dest,source}				
4						
5	source	109				
6	dest	108				

Add a tilde to the end of the {FOR} statement, as shown. Then erase range B5..B6.

Run the \f macro by pressing MACRO-F, and compare the difference. The {LET} command copies the value from *source* to *dest* 108 times in about one second. You will also notice that the screen no longer flickers as it did when you used the Copy command.

So why ever use the Copy command? Because {LET} copies only values, strings, and formula results. It can't copy a formula. After experimenting a bit, you'll know when one copying technique is preferable to the other. ■

What Can a Spreadsheet Compiler Do for You?

If your answer is that a spreadsheet compiler can create templates that run without Lotus 1-2-3, hide macros and formulas from end users, and configure colors and borders, you are only half right.

An advanced spreadsheet compiler can also:
- compile macros and use minimal recalculation to greatly boost performance
- support both expanded and virtual memory to allow large worksheets to run
- have a high degree of compatibility with Lotus 1-2-3 and be very easy to use
- provide a symbolic debugger to assist application development
- customize the appearance of applications with context-sensitive help and vertical menus
- allow you to program part of your application in the C language
- support sideways printing

You can buy a spreadsheet compiler without any of these features, or buy one that has them all. Let the table help you decide.

	Templates run w/o 1-2-3	Secures macros and formulas	Compiles macros	Minimal recalc	Expanded memory	Symbolic debugger	Context-sensitive help	Virtual memory	Sideways printing	User defined functions	Macro loop 3000 times*
King Jaguar	●	●	●	●	●	●	●	●	●	●	.21
Jaguar	●	●	●	●	●	●	●				.21
@ Liberty™ (2.01)	●	●									2:09
1-2-C (1.5)	●	●									3:49
Baler™ (4.0)	●	●									7:01
Lotus 1-2-3® (2.01)				●	●						4:17

*Tested on an 8086 system

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CIRCLE 112 ON READER SERVICE CARD

@WORK

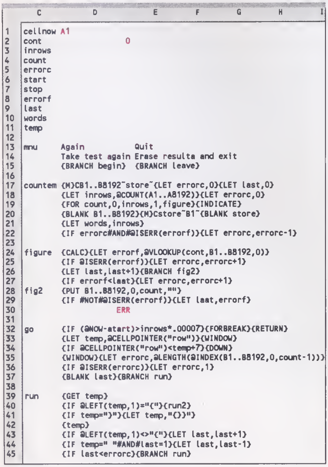
SYMPHONY TYPING TESTER

Create this model to test your typing speed.

BY NICK DELONAS

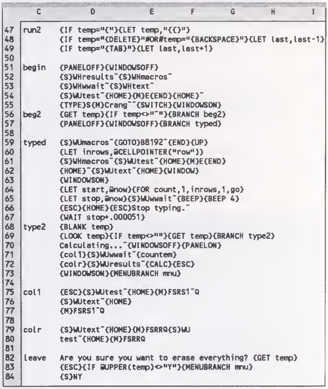
To build this model, you will have to decide what text you want to use for the test. When run, the model displays that text in a window in the top portion of your screen. You type the test into an empty bottom window. Text scrolls in both windows as you type. If you find the scrolling of the text screen disconcerting, simply repeat the test until you're used to it. When the testing time is up, the model calculates your total words per minute and your effective words per minute.

To calculate the effective words per minute, the model



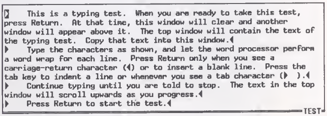
```
     C          D                 E          F          G          H          I
1    cellnow A1
2    cont                      0
3    inrows
4    count
5    errorc
6    start
7    stop
8    errorf
9    last
10   words
11   temp
12
13   mnu     Again             Quit
14           Take test again Erase resulta and exit
15           {BRANCH begin}  {BRANCH leave}
16
17   countem {M}CB1..B8192~store~{LET errorc,0}{LET last,0}
18           {LET inrows,@COUNT(A1..A8192)}{LET errorc,0}
19           {FOR count,0,inrows,1,figure}{INDICATE}
20           {BLANK B1..B8192}{M}Cstore~B1~{BLANK store}
21           {LET words,inrows}
22           {IF errorc#AND#@ISERR(errorf)}{LET errorc,errorc-1}
23
24   figure  {CALC}{LET errorf,@VLOOKUP(cont,B1..B8192,0)}
25           {IF @ISERR(errorf)}{LET errorc,errorc+1}
26           {LET last,last+1}{BRANCH fig2}
27           {IF errorf<laat}{LET errorc,errorc+1}
28   fig2    {PUT B1..B8192,0,count,""}
29           {IF #NOT#@ISERR(errorf)}{LET laat,errorf}
30                         ERR
31
32   go      {IF (@NOW-atart)>inrows*.00007}{FORBREAK}{RETURN}
33           {LET temp,@CELLPOINTER("row")}{WINDOW}
34           {IF @CELLPOINTER("row")<temp+7}{DOWN}
35           {WINDOW}{LET errorc,@LENGTH(@INDEX(B1..B8192,0,count-1))}
36           {IF @ISERR(errorc)}{LET errorc,1}
37           {BLANK last}{BRANCH run}
38
39   run     {GET temp}
40           {IF @LEFT(temp,1)="{"}{run2}
41           {IF temp="}"}{LET temp,"{}}"}
42           {temp}
43           {IF @LEFT(temp,1)<>"{"}{LET last,last+1}
44           {IF temp=" "#AND#last=1}{LET last,last-1}
45           {IF last<errorc}{BRANCH run}
```

FIGURE 1



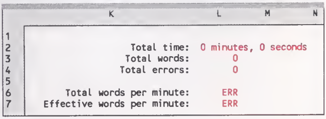
```
     C          D                 E          F          G          H          I
47   run2    {IF temp="{"}{LET temp,"{{}"}
48           {IF temp="{DELETE}"#OR#temp="{BACKSPACE}"}{LET last,last-1}
49           {IF temp="{TAB}"}{LET last,last+1}
50
51   begin   {PANELOFF}{WINDOWSOFF}
52           {S}WHresults~{S}WHmacros~
53           {S}WHwwait~{S}WHtext~
54           {S}WUtest~{HOME}{M}E{END}{HOME}~
55           {TYPE}S{M}Crang~~{SWITCH}{WINDOWSON}
56   beg2    {GET temp}{IF temp<>"~"}{BRANCH beg2}
57           {PANELOFF}{WINDOWSOFF}{BRANCH typed}
58
59   typed   {S}WUmacros~{GOTO}B8192~{END}{UP}
60           {LET inrows,@CELLPOINTER("row")}
61           {S}WHmacros~{S}WUtest~{HOME}{M}E{END}
62           {HOME}~{S}WUtext~{HOME}{WINDOW}
63           {WINDOWSON}
64           {LET start,@now}{FOR count,1,inrows,1,go}
65           {LET stop,@now}{S}WUwwait~{BEEP}{BEEP 4}
66           {ESC}{HOME}{ESC}Stop typing.~
67           {WAIT stop+.000051}
68   type2   {BLANK temp}
69           {LOOK temp}{IF temp<>""}{GET temp}{BRANCH type2}
70           Calculating...~{WINDOWSOFF}{PANELON}
71           {col1}{S}WUwwait~{countem}
72           {colr}{S}WUresults~{CALC}{ESC}
73           {WINDOWSON}{MENUBRANCH mnu}
74
75   col1    {ESC}{S}WUtest~{HOME}{M}FSRS1~Q
76           {S}WUtext~{HOME}
77           {M}FSRS1~Q
78
79   colr    {S}WUtext~{HOME}{M}FSRRQ{S}WU
80           test~{HOME}{M}FSRRQ
81
82   leave   Are you sure you want to erase everything? {GET temp}
83           {ESC}{IF @UPPER(temp)<>"Y"}{MENUBRANCH mnu}
84           {S}NY
```

FIGURE 2



```
▶    This is a typing test.  When you are ready to take this test,
press Return.  At that time, this window will clear and another
window will appear above it.  The top window will contain the text of
the typing test.  Copy that text into this window.◀
▶    Type the characters as shown, and let the word processor perform
a word wrap for each line.  Press Return only when you see a
carriage-return character (◀) or to insert a blank line.  Press the
tab key to indent a line or whenever you see a tab character (▶  ).◀
▶    Continue typing until you are told to stop.  The text in the top
window will scroll upwards as you progress.◀
▶    Press Return to start the test.◀
                                                                 TEST
```

FIGURE 3



```
                        K                        L          M          N
1
2                           Total time:  0 minutes, 0 seconds
3                          Total words:      0
4                         Total errors:      0
5
6              Total words per minute:     ERR
7          Effective words per minute:     ERR
```

FIGURE 4

deducts three words for every mistake. If you rate speed versus accuracy differently, change this deduction factor by replacing the 3 in the formula in cell L7 with another number.

To create this template, follow the instructions in the setup box, and then save your file with the name TYPETEST. To run the test, simply retrieve the file.

Note that the time required to complete the typing test varies proportionately with the length of the text in the text window. The test should consist of at least 20 lines of text. The model tells you to stop typing after a couple of minutes, depending on the length of the text. ■

HOW TO SET UP THE TYPING-TEST WORKSHEET

1. Create MACROS window
Select SERVICES Window Create and enter *macros*. Select SHEET, press Return to accept the screen-area default, and select Quit. Select SERVICES Window Delete, then select MAIN.

2. Individual column widths in MACROS window

Column	Width
A	72
B	72
D	16
K	31

For example, to set the width of column A, place the cell pointer in column A, select MENU Width Set, and enter 72.

3. Cell formats

Format	Range
Fixed 0	L3..L7

Select MENU Format Fixed, enter 0, indicate range L3..L7, and press Return.

4. Labels in MACROS window
Enter all labels shown in figures 1, 2, and 4. Omit entries printed in red (ranges D1..D2, D30, L2..L4, and L6..L7). Right-align the labels in range K2..K7. Select MENU Range Label-Alignment Right, and indicate range K2..K7.

5. Range names

Name	Range
rang	D86..D96
store	O1..O8192
beg2	D56
begin	D51
cellnow	D1
col1	D75
colr	D79
cont	D2
count	D4
countem	D17
errorc	D5
errorf	D8
fig2	D28
figure	D24
go	D32
inrows	D3
last	D9
leave	D82
mnu	D13
run	D39
run2	D47
start	D6
stop	D7
temp	D11
type2	D68
typed	D59
words	D10

To assign the first two range names, select MENU Range Name Create, enter the name, and indicate the range. To assign the rest of the range names, move the cell pointer to cell C1, select MENU Range Name Labels Right, and indicate range C1..C82.

6. Enter and copy formulas

Cell	Formula
D1	+"A"&@STRING(count+1,0)
D2	@@(cellnow)
D30	+"{INDICATE "& @STRING(100−(inrows −count)*100/inrows, 0)&"%}"
L2	+" "&@STRING(@MINUTE (stop−start),0)& " minutes, "&@STRING (@SECOND(stop−start), 0)&" seconds"
L3	+words
L4	+errorc
L6	+words/((stop−start)*1440)
L7	(words−3*errorc)/((stop−start)*1440)

7. Set autoexecute macro
Select SERVICES Settings Auto-Execute Set, enter *begin*, and then select Quit.

8. Create TEST window
Select SERVICES Window Create and enter *test*. Select DOC, press the period key twice, press the DownArrow key nine times, and then press Return. Select Restrict Range and enter A1..A8192. Select Borders Line and select Quit.

9. Special text
Enter the text exactly as it is shown in figure 3 in the TEST window. To create the Return character enclosed in parentheses (◀), enter a left parenthesis and press Return. Press the TYPE key and select SHEET. Press the UpArrow key, press the EDIT key, type a right parenthesis after the Return character, press Return, and then press the SWITCH key.

When you are finished, press the WINDOW key and copy range A1. A11 to cell D86.

10. Create TEXT window
Select SERVICES Window Create and enter *text*. Select DOC, press the UpArrow key 13 times, then press Return. Select Restrict Range and enter B1..B8192. Select Borders Line, then select Quit.

11. Enter text
In the TEXT window, enter whatever material you want to use as a typing test. The four paragraphs of this article work well. In any case, use at least 20 lines of text for a valid test.

12. Create WWAIT window
Select SERVICES Window Use and indicate MACROS. Select SERVICES Window Create and enter *wwait*. Select SHEET. Press the UpArrow key 7 times, press the LeftArrow key 12 times, and press the period key twice. Press the DownArrow key 5 times, press the RightArrow key 12 times, then press Return. Select Restrict Range and enter K9..K16. Select Borders Line and select Quit. Select MENU Width Set, enter 54, and press Return.

13. Create RESULTS window
Select SERVICES Window Create and enter *results*. Select SHEET. Press Return to select the same area used by the WWAIT window. Select Restrict Range and enter K1..M8. Select Borders Line and select Quit. Select MENU Width Set and enter 31. Press the RightArrow key, select MENU Width Set, and enter 5.

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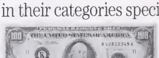

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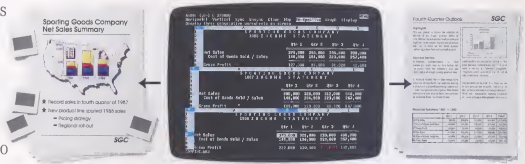

```
A:B5: (,0-) U 370000                                                    MENU
Horizontal  Vertical  Sync  Unsync  Clear  Map  Perspective  Graph  Display
Display three consecutive worksheets on screen
                  A                        B         C         D         E
1                   S P O R T I N G   G O O D S   C O M P A N Y
2                      1988 I N C O M E   S T A T E M E N T
3
4                                        Qtr 1     Qtr 2     Qtr 3     Qtr 4
5
6   Net Sales                          275,000   250,000   255,000   300,000
7     Cost of Goods Sold / Sales       148,000   184,500   223,080   257,400
8
9   Gross Profit                       127,000    [illegible]     31,920    42,600
                  A                        B         C         D         E
1                   S P O R T I N G   G O O D S   C O M P A N Y
2                      1987 I N C O M E   S T A T E M E N T
3
4                                        Qtr 1     Qtr 2     Qtr 3     Qtr 4
5
6   Net Sales                          300,000   328,000   312,000   346,000
7     Cost of Goods Sold / Sales       148,000   194,500   223,080   267,400
8
9   Gross Profit                       162,000   130,500    [illegible]    [illegible]
                  A                        B         C         D         E
1                   S P O R T I N G   G O O D S   C O M P A N Y
2                      1988 I N C O M E   S T A T E M E N T
3
4                                        Qtr 1     Qtr 2     Qtr 3     Qtr 4
5
6   Net Sales                          370,000   328,000   210,000   400,000
7     Cost of Goods Sold / Sales       148,000   194,000   223,000   257,400
8
9   Gross Profit                       222,000   130,500   [illegible]   142,600
COMPINC.WK3
```

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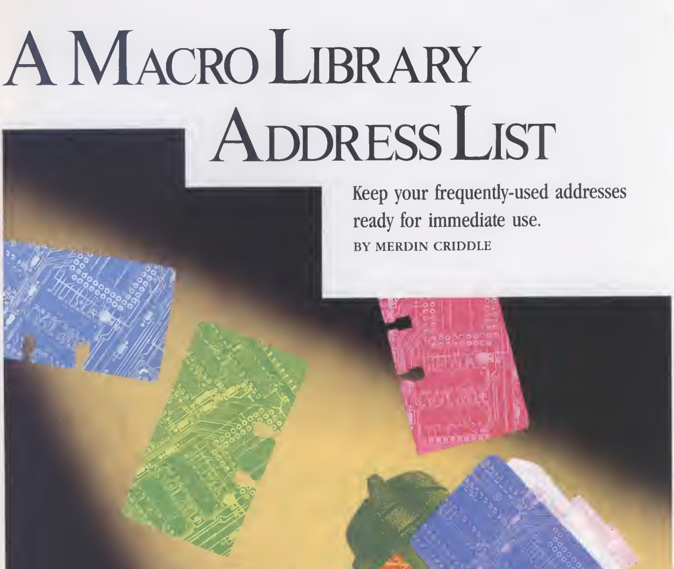
A MACRO LIBRARY ADDRESS LIST

Keep your frequently-used addresses ready for immediate use.

BY MERDIN CRIDDLE



GENE GREIF

Many people use PCs almost entirely for spreadsheets. If you are one of those people, perhaps you put off writing letters because of the extra steps needed to end your spreadsheet session and crank up your word-processing software. But what if you want to dash off a short note to an associate or client the moment an idea hits you?

You can satisfy this urge while running *1-2-3* or *Symphony*, even with your current project still in memory. This is easier to do in *Symphony*, which offers a word-processing environment, but producing a short letter in a *1-2-3* spreadsheet is not an unreasonable task.

To make such spontaneous letter writing convenient, turn your name and address and the names and addresses of your most-frequent correspondents into macros. Then store the macros in memory, using the Macro Library Manager add-in that is included with *Symphony* Releases 1.1, 1.2, and 2.0 and with the newly released *1-2-3* Release 2.2. These macros remain available even if you clear your worksheet or retrieve a new one. They'll allow you to produce the heading and salutation of a letter in a few seconds by invoking a couple of mnemonic keywords.

For example, suppose you've just tabulated some sales figures and you notice that one of the offices isn't selling up to par with the others. You decide to send a note to that office's manager, whose name is Bunker. To start the letter, press the USER key and enter the word *letter* (*Symphony*) or press RUN and select that item from the control panel (*1-2-3* Release 2.2). In a few seconds, your name and address and the current date appear in an unused area of the worksheet. Press the USER key again and type *bunker* (*Symphony*) or press RUN and select BUNKER from the control panel (*1-2-3*). Bunker's name and address are automatically entered below the date. Now you're ready to type the letter.

Be aware that this system is different from a mail-merge program. Last month's *LOTUS* presented instructions for performing mail-merge operations in *1-2-3*. This system is much simpler, sort of an electronic Rolodex. Note also that this article doesn't deal with addressing envelopes.

The Macro Library Manager included with *1-2-3* Release 2.2 is virtually identical to the *Symphony* version, and the methods for saving address macros and using them to create letters are similar. Still, there are some important differences, so we will look at each procedure separately.

ADDRESS LISTS WITH SYMPHONY

To begin, you'll need to attach the Macro Library Manager file, MACROMGR.APP, or configure *Symphony* to attach it automatically on startup.

If you run *Symphony* from your hard disk, the add-in should be in the same subdirectory that contains *Symphony*'s program files. If you run *Symphony* from a floppy disk, put the Help and Tutorial Disk in the same drive you started *Symphony* from. Then, for either the hard or floppy disk, press SERVICES, select Application Attach, highlight the file name MACROMGR.APP in the control panel, and press Return; then select Quit.

If you want the Macro Library Manager to be attached automatically when you start *Symphony*, select SERVICES Configuration Other Application. You should now see a table showing any applications that are set to be attached, or invoked, automatically. Select Set, then select 1 or the first available number in the table, highlight the file name MACROMGR.APP and press Return, select No, then select Quit Update Quit.

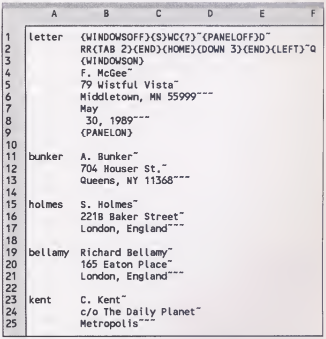
Now enter the labels shown in figure 1, but don't enter anything in cells B7 and B8 yet. Remember to type an apostrophe before any labels that begin with numerals and to type the tildes (~) exactly as they appear in the figure. Each tilde represents one press of the Return key.

Now enter these two formulas, the first into cell B7 and the second into cell B8:

```
@CHOOSE(@MONTH(@NOW)-1,"January",
  "February","March","April","May",
  "June","July","August","September",
  "October","November","December")

+" "&@STRING(@DAY(@NOW),0)&", "&
  @STRING(1900+@YEAR(@NOW),0)&"~~~"
```

The labels in column A are used to assign names to cells in column B. These names will be the keywords to



```
        A         B          C          D          E          F
 1   letter    {WINDOWSOFF}{S}WC{?}~{PANELOFF}D~
 2             RR{TAB 2}{END}{HOME}{DOWN 3}{END}{LEFT}~Q
 3             {WINDOWSON}
 4             F. McGee~
 5             79 Wistful Vista~
 6             Middletown, MN 55999~~~
 7             May
 8              30, 1989~~~
 9             {PANELON}
10
11   bunker    A. Bunker~
12             704 Houser St.~
13             Queens, NY 11368~~~
14
15   holmes    S. Holmes~
16             221B Baker Street~
17             London, England~~~
18
19   bellamy   Richard Bellamy~
20             165 Eaton Place~
21             London, England~~~
22
23   kent      C. Kent~
24             c/o The Daily Planet~
25             Metropolis~~~
```

FIGURE 1. The *Symphony* versions of the address-list macros are designed to be used while in a DOC window. The tildes (~) at the ends of labels represent presses of the Return key, which cause *Symphony* to end a line with a hard-carriage return and move the cursor to the beginning of the next line. The entries in cells B7 and B8 are string-returning formulas whose values are controlled by the current date.

Merdin Criddle wrote about teaching linear equations with a spreadsheet in the October 1987 issue of LOTUS.

use when setting up a letter or producing an address. Select MENU Range Name Labels Right and specify range A1..A23.

Now you're ready to copy all these macros, as a library, into memory. This is also called putting the macros in Hyperspace. First, in order to make it easy to find the macro library when you want to use it, make sure that the current directory is *Symphony*'s default directory. Select SERVICES File Directory. If the current directory is the default directory, press Return; otherwise, press Escape and enter the directory name, for example, C:\SFILES. If you have a hard disk but your initial current directory is on a floppy-disk drive, make current the *Symphony* program-files directory. If you don't have a hard disk, you can store the macro library on a floppy disk.

Now press SERVICES. Note that there's a new menu option, Macros, at the extreme right of the control panel. This option is added to the SERVICES menu when you attach the Macro Library Manager. Select Macros, then select Save, enter *letter*, highlight range A1..B25 and press Return, then select No. All the labels you've typed disappear from the screen, but they're still in your computer's memory, where they'll stay until you end your *Symphony* session or until you remove the library.

To see how the macros work, first retrieve any worksheet you've created. Then press the USER key (F7 on most systems), type *letter*, and press Return. After a second, you see a prompt for a new window name. Enter any name not already in use, for example, *ltr*. The macro creates a new window, makes it a DOC (word-processing) window, and assigns a Restrict range that begins three rows below the worksheet's previous active area.

If you made any mistakes entering the macro, a message at the bottom of the screen will tell you of an error in the *letter* macro library. If this happens, you must bring the macros back into your worksheet, correct the mistakes, and copy them back into memory. See the next section for instructions on how to edit the macro library.

Next the macro types *F. McGee* and presses Return, types *79 Wistful Vista* and presses Return, types *Middletown, MN 55999* and presses Return three times, then types the date and presses Return three more times.

Now you can invoke a macro that types the name and address of the recipient. For example, if you wish to send a letter to your friend Holmes in London, press the USER key and enter *holmes*. The macro types out the name and address of S. Holmes at 221B Baker Street in London, England, finishing with three Returns.

These macros make it easy to dash off a short note the moment an idea hits you.

Once the letter has been set up, you can begin typing its body. When you're ready to print the letter, select SERVICES Print. If the Print settings sheet indicates that a Print range already exists, select Settings Source Cancel. When working in a DOC window, you do not need to specify a range. *Symphony* will print the entire document.

Change any other settings, such as margins or setup strings, in the usual way, then return to the main Print menu and select Align Go. When you've printed your letter, you can erase it from the worksheet, first extracting it to a separate worksheet file if you wish. Then return to the spreadsheet's MAIN window and delete the letter window: Select SERVICES Window Delete, highlight LTR, and press Return.

EDITING THE SYMPHONY MACRO LIBRARY

At some point, you'll want to add, delete, or change addresses from the library. In any case, you'll want to replace the fictional names used in the example with your own name and the names of your correspondents. Clear your worksheet, then select SERVICES Macros Edit, highlight the name LETTER and press Return. Then press Return twice more to select Ignore and to specify the current cell address as the location for the library.

Note that you can bring a macro library into the worksheet without clearing the screen first. Make sure you select a location for the library where the incoming labels won't replace any entries in your worksheet. If the library has range names that also exist in the worksheet, those range names will be removed from the library if you select Ignore after specifying the library. If you select Overwrite, the library retains its range names, and any duplicate names in the worksheet will be eliminated.

Erase range A11..B25, and clear the range names by selecting MENU Range Name Reset Yes. Then replace the entries in range B4..B6 with your own name and address. If you have more than a two-line address, insert rows into the worksheet as needed. Remember to include a tilde after your name and after each line in your address except the last one. The three tildes that end the last line create two blank rows between your address and the date.

Leaving one empty row after the label {PANELON} in column B, enter in column A a word you associate with someone you often send notes to. This can be a last name, a nickname, a job title. Next to that label, in column B, type the person's full name, followed by a tilde. In the cells below this, type the person's address, finishing each line with a tilde and the last line with three tildes.

Repeat this procedure for your other correspondents. Then assign range names by selecting MENU Range Name Labels Right and specifying the range that extends from cell A1 to the last entry you made in column A. Finally, save the library in its revised form: Select SERVICES Macros Save and enter *letter*. You see the message *Library exists BOTH in memory and on disk. Overwrite?* Select Yes, specify a range that includes all the labels you've entered, and select No.

To use this library in future *Symphony* sessions, first attach the Macro Library Manager (unless you've set it to be attached automatically) and make current the directory where you stored the library. Then select SERVICES Macros Load, highlight the word LETTER on the control panel and press Return, and select Quit.

ADDRESS LISTS WITH 1-2-3 RELEASE 2.2

To begin, you'll need to attach the Macro Library Manager file, MACROMGR.ADN, or configure *1-2-3* to attach it automatically on startup.

If you run *1-2-3* from your hard disk, the add-in should be in the same subdirectory as *1-2-3*'s program files. If you run *1-2-3* from a floppy disk, put the Install Disk in the drive you started *1-2-3* from.

If you want the Macro Library Manager to be attached automatically every time you start *1-2-3*, skip to the next paragraph. If you don't, press slash, select Add-In Attach, highlight the file name MACROMGR.ADN in the control panel, and press Return. You then see a menu showing the Alt key–function key combinations that are available for invoking the add-in. Assuming that no add-ins are already attached, the choices are No-Key, 7, 8, 9, and 10. Select 7, then select Quit. If 7 is unavailable, select another number and substitute the appropriate function key number wherever Alt-F7 appears in the next several paragraphs.

To make the Macro Library Manager attach automatically, select /Worksheet Global Default Other Add-In Set. You now see a table showing what add-ins are already set to attach automatically. Select 1 or the first available number in the table, highlight MACROMGR.ADN and press Return, select 7 (or an available function key), select No, then select Quit Update Quit.

Now enter the labels shown in figure 2, but don't enter anything in cells B5 and B6 yet. Note that when you enter address lines that begin with a numeral, such as *79 Wistful Vista*, you must begin the entry with two apostrophes. The second apostrophe is an instruction to the macro to type an apostrophe when it enters the label in a cell.

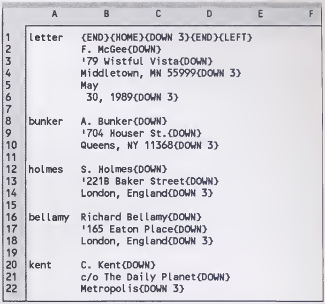
Now enter these two formulas, the first in cell B5 and the second in cell B6:

```
@CHOOSE(@MONTH(@NOW)−1,"January",
  "February","March","April","May",
  "June","July","August","September",
  "October","November","December")

+" "&@STRING(@DAY(@NOW),0)&", "&
  @STRING(1900+@YEAR(@NOW),0)&"{DOWN 3}"
```

The labels in column A are used to assign names to cells in column B. These names will be the keywords to use when setting up a letter or producing an address. Select /Range Name Labels Right and specify range A1..A20.

Now you're ready to copy all these macros, as a library, into memory. This is also called putting the macros in Hyperspace. First make sure that the current directory is *1-2-3*'s default directory. This is to help you find the macro library when you want to use it. Select /File Directory. If the current directory is the default directory, press Return; otherwise, enter the default directory name, for example, C:\123FILES. If you have a hard disk but your default directory is on a floppy disk, make current the *1-2-3* program-files directory. If you don't have a hard disk, you can store the macro library on a floppy disk.



```
        A         B          C          D          E         F
 1  letter   {END}{HOME}{DOWN 3}{END}{LEFT}
 2           F. McGee{DOWN}
 3           '79 Wistful Vista{DOWN}
 4           Middletown, MN 55999{DOWN 3}
 5           May
 6            30, 1989{DOWN 3}
 7
 8  bunker   A. Bunker{DOWN}
 9           '704 Houser St.{DOWN}
10           Queens, NY 11368{DOWN 3}
11
12  holmes   S. Holmes{DOWN}
13           '221B Baker Street{DOWN}
14           London, England{DOWN 3}
15
16  bellamy  Richard Bellamy{DOWN}
17           '165 Eaton Place{DOWN}
18           London, England{DOWN 3}
19
20  kent     C. Kent{DOWN}
21           c/o The Daily Planet{DOWN}
22           Metropolis{DOWN 3}
```

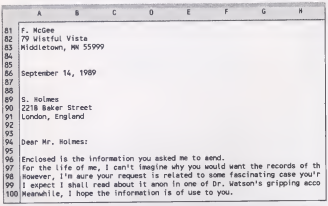
FIGURE 2. The *1-2-3* Release 2.2 versions of the macros enter labels in cells by typing them and pressing the DownArrow key. Note that any address lines that begin with numerals must be prefaced with two apostrophes (only one of which appears on the worksheet screen) because the macro must type an apostrophe when entering such a label. The entries in cells B5 and B6 are string-returning formulas whose values are controlled by the current date.

Now hold down the Alt key and press F7. This calls up the Macro Library Manager menu. Select Save, enter *letter*, highlight range A1..B22 and press Return, then select No. All the labels you've typed disappear from the screen, but they're still in your computer's memory, where they'll stay until you end your *1-2-3* session or until you remove the library.

You can also save this library using the name *autoload*. If you do, its macros will be available as soon as you attach the Macro Library Manager (or when you start *1-2-3* if the add-in is set to be attached automatically).

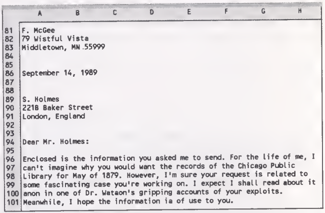
To see how the macros work, first retrieve any worksheet you've created. Then press the RUN key, highlight LETTER on the control panel, and press Return. The macro positions the cell pointer in column A just below the worksheet's active area, enters *F. McGee* in the current cell, enters *79 Wistful Vista* in the next cell down, enters *Middletown, MN 55999* in the cell below that, moves the pointer down three rows, enters the current date in label form, and moves the pointer down three more rows.

Now you can invoke a macro that types the name and address of the recipient. For example, if you wish to send



```
      A        B        C        0        E        F        G        H
81  F. McGee
82  79 Wistful Vista
83  Middletown, MN 55999
84
85
86  September 14, 1989
87
88
89  S. Holmes
90  221B Baker Street
91  London, England
92
93
94  Dear Mr. Holmes:
95
96  Enclosed is the information you asked me to aend.
97  For the life of me, I can't imagine why you would want the records of th
98  However, I'm aure your request is related to some fascinating case you'r
99  I expect I shall read about it anon in one of Dr. Watson's gripping acco
100 Meanwhile, I hope the information is of use to you.
```

FIGURE 3a. When entering text in *1-2-3*, it's easiest to enter long labels in successive cells, then justify the text. In this example, you would select /Range Justify and specify range A96..H96.



```
      A        B        C        D        E        F        G        H
81  F. McGee
82  79 Wistful Vista
83  Middletown, MN .55999
84
85
86  September 14, 1989
87
88
89  S. Holmes
90  221B Baker Street
91  London, England
92
93
94  Dear Mr. Holmes:
95
96  Enclosed is the information you asked me to send. For the life of me, I
97  can't imagine why you would want the records of the Chicago Public
98  Library for May of 1879. However, I'm sure your request is related to
99  some fascinating case you're working on. I expect I shall read about it
100 anon in one of Dr. Wataon's gripping accounts of your exploits.
101 Meanwhile, I hope the information ia of use to you.
```

FIGURE 3b. This shows how the text in figure 3a appears after you use the Range Justify command.

a letter to your friend Holmes in London, press the RUN key and highlight HOLMES. The macro enters the name and address of S. Holmes at 221B Baker Street in London, England, in the next three cells, then moves the pointer down three more rows.

Once the letter has been set up, you can begin typing its body. Enter the text as long labels in successive cells. To justify the text, move the cell pointer to the first label you entered, select /Range Justify, then move the cell pointer to the right until the highlighted area includes as many columns as are displayed in one screen. Take a look at figure 3a. This is how a letter might look before it gets justified. Note that most of the labels are longer than the width of the screen. To justify this text, you would select /Range Justify and specify range A96..H96. When you do this, the text is arranged into labels of 72 or slightly fewer characters, as in figure 3b.

When you're ready to print the letter, select /Print Printer. If the Print settings sheet indicates that a Print range already exists, press Backspace, then press period and highlight a new range that encompasses your letter. Change any other settings, such as margins or setup strings, in the usual way. Then return to the main Print menu and select Align Go. When you've printed your letter, you can erase it from the worksheet, first extracting it to a separate worksheet file if you wish.

EDITING THE 1-2-3 MACRO LIBRARY

At some point you'll want to add, delete, or change addresses from the library. In any case, you'll want to replace the fictional names used in the example with your own name and the names of your correspondents. Clear your worksheet, then press Alt-F7, select Edit, highlight LETTER and press Return, and press Return twice more to select Ignore and to specify the current cell address as the location for the library.

Note that you can also bring a macro library into the worksheet without clearing the screen first. Make sure that you select a location for the library where the incoming labels won't replace any entries in your worksheet. If the library has range names that also exist in the worksheet, those range names will be removed from the library if you select Ignore after specifying the library. If you select Overwrite, the incoming library retains its range names and any duplicate names in the worksheet will be eliminated.

Erase range A8..B22, and clear the range names by selecting /Range Name Reset. Then edit the labels in range B2..B4, replacing the name and address with your own. If you have more than two lines in your address, insert rows into the worksheet as needed. Remember that each line in your address must end with the keyword {DOWN} or {D}, except for the last line, which should end with {DOWN 3} or {D 3}.

Leaving one empty row after the day-and-year formula in column B, enter in column A a word you associate with someone you often send letters to. This can be a last name, a nickname, a job title, whatever. Next to that label, in column B, type the person's full name, followed by the characters {DOWN}. In the cells below this, type the person's address, finishing each line with {DOWN} and the last line with {DOWN 3}.

Repeat this procedure for your other correspondents. Remember to start with two apostrophes when entering an address line that begins with a numeral. Then assign range names by selecting /Range Name Labels Right and specifying the range that extends from cell A1 to the last entry you made in column A. Finally, save the library in its revised form: Press Alt-F7, select Save, and enter *letter* (or *autoload*). You see the message *Macro library already exists in memory and on disk. Write over it?* Select Yes, specify a range that includes all the labels you've entered, and select No.

To use this library in future *1-2-3* sessions, first attach the Macro Library Manager (unless you've set it to attach automatically) and make current the directory where you stored the library. Then press Alt-F7, select Load, highlight LETTER on the control panel and press Return, and select Quit. As mentioned earlier, you do not need to load the library if you save it under the name *autoload*. ■

NEW VERSION
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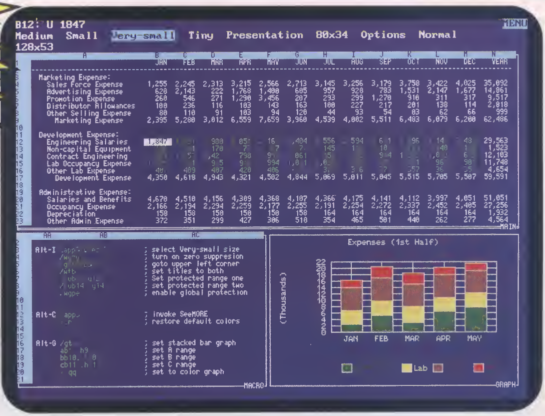

```
B12: U 1847                                                                    MENU
Medium  Small  Very-small  Tiny  Presentation  80x34  Options  Normal
128x53
              A                   B      C      D      E      F      G      H      I      J      K      L      M      N
                                 JAN    FEB    MAR    APR    MAY    JUN    JUL    AUG    SEP    OCT    NOV    DEC   YEAR
 ------------------------------------------------------------------------------------------------------------------------
 Marketing Expense:
   Sales Force Expense         1,255  2,245  2,313  3,215  2,566  2,713  3,145  3,256  3,179  3,758  3,422  4,025  35,092
   Advertising Expense           620  2,143    222  1,768  1,400    605    957    920    783  1,531  2,147  1,677  14,861
   Promotion Expense             260    546    271  1,290  3,456    207    293    299  1,270    910    311    317   9,517
   Distributor Allowances        100    236    116    103    143    163    100    227    217    201    138    114   2,818
   Other Selling Expense          80    110     91    103     94    120     44     93     54     83     62     66     999
     Marketing Expense         2,395  5,280  3,012  6,559  7,659  3,960  4,539  4,002  5,511  6,483  6,079  6,200  62,486

 Development Expense:
   Engineering Salaries        1,847 [illegible]  900 [illegible] [illegible] [illegible] 556 [illegible] [illegible] [illegible] [illegible] [illegible] 29,563
   Non-capital Equipment       [illegible] [illegible] 170 [illegible] [illegible] [illegible] 145 [illegible] 10 [illegible] [illegible] [illegible] 1,523
   Contract Engineering        [illegible] [illegible] [illegible] 790 [illegible] 061 [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] 12,103
   Lab Occupancy Expense       [illegible] [illegible] [illegible] [illegible] 994 [illegible] [illegible] [illegible] [illegible] [illegible] 96 [illegible] 11,748
   Other Lab Expense           [illegible]  409    407    420    406 [illegible] [illegible] [illegible] [illegible] [illegible] 36 [illegible] 4,654
     Development Expense       4,350  4,618  4,943  4,321  4,502  4,844  5,069  5,011  5,045  5,515  5,705  5,507  59,591

 Administrative Expense:
   Salaries and Benefits       4,670  4,510  4,156  4,309  4,368  4,107  4,366  4,175  4,141  4,112  3,997  4,051  51,051
   Occupancy Expense           2,166  2,194  2,294  2,259  2,177  2,255  2,191  2,254  2,272  2,337  2,452  2,405  27,256
   Depreciation                  158    158    150    150    150    158    164    164    164    164    164    164   1,932
   Other Admin Expense           372    351    299    427    306    510    354    465    501    440    262    277   4,564
                                                                                                                    MAIN
      AA        AB             AC
 Alt-I [illegible]             ; select Very-small size
       [illegible]             ; turn on zero suppresion
       [illegible]             ; goto upper left corner
       /wtb                    ; set titles to both
       [illegible]             ; Set protected range one
       [illegible]             ; set protected range two
       .wgpe                   ; enable global protection

 Alt-C [illegible]             ; invoke SeeMORE
       [illegible]             ; restore default colors

 Alt-G /gt                     ; set stacked bar graph
       [illegible]             ; set A range
       [illegible]             ; set B range
       [illegible]             ; set C range
       [illegible]             ; set to color graph
                                                  MACRO
```

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POPULATION FORECASTING

Are Census Bureau predictions realistic? It's not too difficult to produce your own.

BY EVERETTE S. GARDNER, JR.

If you make plans that depend on the future population of the United States, it's tempting to use the forecasts published by the U.S. Census Bureau. Its current forecasts through the year 2000, however, may be based on wishful thinking. If you don't agree with those assumptions, it may be wise to produce your own forecast. You can easily produce a reasonable alternative to the Census Bureau's forecast by using *1-2-3* Release 2/2.01, 2.2, or 3 or *Symphony* Release 1.2 or 2.0 with the statistical add-in attached.

The simplest forecasting model is a straight line that is fitted to and extends beyond existing data. You determine the origin and slope of this line by using linear regression. In my March 1987 article, "Using Exponential Smoothing," I argued that this type of model is rarely useful because it is difficult to find real business data that grow according to a straight line. When forecasting the United States population growth, however, these straight-line forecasts look a lot more reasonable.

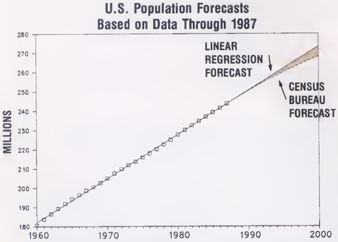


FIGURE 1. This graph demonstrates that the population figures for 1960 to 1987 tell almost on a straight line. Extending the line in the same direction to the year 2000 indicates that the population will reach 273 million by that time. The U.S. Census Bureau's forecasts, based on assumptions of decreased immigration and births, predict a population of 268 million by the year 2000.

Figure 1 shows that actual year-to-year population values, represented by the squares, have indeed fallen along a straight line since 1960. The line running through the boxes was produced by performing a linear regression on the known data and using the results to compute a set of predicted populations through the year 2000. In 1987, the most recent year for which Census Bureau data is available, the population was 243,773,000. By the year 2000, the regression line projects growth to 273,410,000.

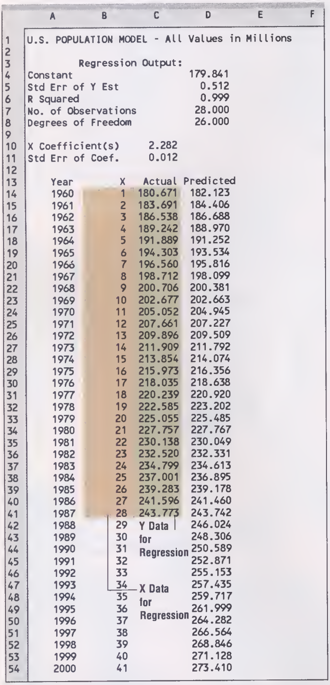
In January the Census Bureau published its forecast of annual populations through the year 2080, predicting growth to 268,266,000 by the year 2000. Figure 1 shows how the Census Bureau's forecast falls behind the regression forecast. A crucial assumption behind the bureau's forecast is that the level of immigration will gradually decline between now and the end of the century. I agree, however, with *Time*'s assessment (February 27, 1989) that "the immigration wave is not likely to stop or even slow." The Census Bureau also assumes that the number of births will gradually decline through the year 2000. In my opinion, this also is unlikely.

A straight-line forecast can be justified by opinions about immigration and birth rates. The technique's reliability can be proved by using historical data to "forecast" known population figures. The table below shows the results of a five-year forecasting test. The regression forecasts were based on population data for 1960 to 1982. The Census Bureau forecasts were made in May 1984 and were based on population data up to 1982. They differ

		Regression		Census Bureau	
Year	Actual	Forecast	Error	Forecast	Error
1983	234.799	234.499	.300	234.223	.576
1984	237.001	236.773	.228	236.416	.585
1985	239.283	239.048	.235	238.631	.652
1986	241.596	241.322	.274	240.856	.740
1987	243.773	243.597	.176	243.084	.689
Total Errors			1.213		3.242

(All values are in millions)

MICHAEL PARASKEVAS



```
        A         B         C         D         E         F
 1  U.S. POPULATION MODEL - All Values in Millions
 2
 3         Regression Output:
 4  Constant                          179.841
 5  Std Err of Y Est                    0.512
 6  R Squared                           0.999
 7  No. of Observations                28.000
 8  Degrees of Freedom                 26.000
 9
10  X Coefficient(s)          2.282
11  Std Err of Coef.          0.012
12
13       Year          X    Actual Predicted
14       1960          1   180.671   182.123
15       1961          2   183.691   184.406
16       1962          3   186.538   186.688
17       1963          4   189.242   188.970
18       1964          5   191.889   191.252
19       1965          6   194.303   193.534
20       1966          7   196.560   195.816
21       1967          8   198.712   198.099
22       1968          9   200.706   200.381
23       1969         10   202.677   202.663
24       1970         11   205.052   204.945
25       1971         12   207.661   207.227
26       1972         13   209.896   209.509
27       1973         14   211.909   211.792
28       1974         15   213.854   214.074
29       1975         16   215.973   216.356
30       1976         17   218.035   218.638
31       1977         18   220.239   220.920
32       1978         19   222.585   223.202
33       1979         20   225.055   225.485
34       1980         21   227.757   227.767
35       1981         22   230.138   230.049
36       1982         23   232.520   232.331
37       1983         24   234.799   234.613
38       1984         25   237.001   236.895
39       1985         26   239.283   239.178
40       1986         27   241.596   241.460
41       1987         28   243.773   243.742
42       1988         29             246.024
43       1989         30             248.306
44       1990         31             250.589
45       1991         32             252.871
46       1992         33             255.153
47       1993         34             257.435
48       1994         35             259.717
49       1995         36             261.999
50       1996         37             264.282
51       1997         38             266.564
52       1998         39             268.846
53       1999         40             271.128
54       2000         41             273.410
```

FIGURE 2. This simple worksheet lets you predict the population over the next several years, using simple linear regression. The regression values in range A3..D11 are based on the consecutive values in range B14..B41 and the known populations in range C14..C41. The predicted populations in range D14..D54 are computed by multiplying the corresponding value in column B by the regression X coefficient in cell C10 and adding the constant in cell D4.

from what actually came to pass by a much larger margin than the regression forecasts.

I should emphasize that this forecasting test is based on only one five-year sample. Performing the same test with different starting years may produce larger or smaller differences between regression forecasts and those of the Census Bureau. However, the error margins shown in the table should be enough to convince you that the straight-line regression model is worth consideration.

REGRESSION-BASED FORECASTS

To duplicate the population forecast I used to make the graph, enter a series of years in one column of your worksheet, starting with the earliest year for which you have data and ending with the year through which you are forecasting. In the next column enter consecutive numbers starting with 1, and in a third column enter the known population values.

Next, produce a regression table: For the X values, use as many of the numbers in the second column as there are known population numbers. For the Y values, use the known populations themselves.

Finally, compute the predicted population values: Multiply each X value by the X coefficient from the regression data and add the constant from the regression data.

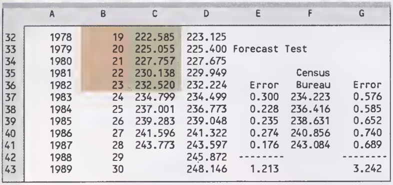
To do all this, create the worksheet shown in figure 2 by following the instructions in the setup box on the opposite page. Note that the regression output in range A3..D11, including the labels, is created automatically when you issue the regression commands. The next two paragraphs explain how to produce the regression table.

If you use *1-2-3,* skip to the next paragraph. In *Symphony*, you must first attach the statistical application STAT.APP. If you run *Symphony* from a hard disk, STAT.APP should be in the directory that has the *Symphony* program files. If you run *Symphony* from a floppy disk, place the Help and Tutorial Disk in drive A. Select SERVICES Application Attach, select STAT.APP from the menu, then select Quit.

Press slash and select Data Regression (in *Symphony*, MENU Range Regres), select X-Range and specify range B14..B41, select Y-Range and specify range C14..C41, select Output-Range and specify cell A3, then select Go. After a moment, range A3..D11 of your worksheet matches that range in figure 2, and the formulas in range D14..D54 return the values shown in the figure.

RUNNING A FORECASTING TEST

To show how accurately this model predicts the populations for the years 1983 to 1987, issue the regression commands again, but adjust the X and Y ranges to B14..B36 and C14..C36, respectively. This creates a new set of values in range A3..D11. The predicted-population formulas in column D, which depend on two of the regression values, change accordingly. Enter the labels shown in range E33..G36 of figure 3, then right-align the labels in rows 35 and 36 by selecting /Range Label Right (in *Sym-*



	A	B	C	D	E	F	G
32	1978	19	222.585	223.125			
33	1979	20	225.055	225.400	Forecast Test		
34	1980	21	227.757	227.675			
35	1981	22	230.138	229.949		Census	
36	1982	23	232.520	232.224	Error	Bureau	Error
37	1983	24	234.799	234.499	0.300	234.223	0.576
38	1984	25	237.001	236.773	0.228	236.416	0.585
39	1985	26	239.283	239.048	0.235	238.631	0.652
40	1986	27	241.596	241.322	0.274	240.856	0.740
41	1987	28	243.773	243.597	0.176	243.084	0.689
42	1988	29		245.872	--------		--------
43	1989	30		248.146	1.213		3.242

FIGURE 3. To see how this model performs when only the data through 1982 is known, rerun the regression, first adjusting the X and Y ranges to B14..B36 and C14..C36. The shaded areas indicate the new lower limits of these ranges. Compute errors for the years 1983 to 1987 by subtracting the new predicted populations from the actual populations for those years. Enter the Census Bureau data in column F and subtract those values from actual values to see how close the bureau's predictions were.

phony, MENU Range Label-Right) and specifying range E35..G36. Enter the formula +$C37−D37 in cell E37 and copy this cell to range E38..E41. Enter a space and eight hyphens in cell E42 and enter the formula @SUM (E37..E41) in cell E43. The resulting values show that the forecast missed predicting the actual populations for 1983 to 1987 by 176,000 to 300,000. The total error for the five years was about 1.2 million.

To see how well the Census Bureau did for the same period with the same base of historical data, enter the values shown in range F37..F41 of figure 3, then copy range E37..E43 to cell G37. You'll see that the bureau missed the mark by 576,000 to 740,000, with a total error of about 3.2 million.

Remember that you've adjusted the worksheet so that the forecasts through the year 2000 are based on actual populations from 1960 to 1982. To make projections based on all available data, be sure to rerun the regression using B14..B41 and C14..C41 as the X and Y ranges.

As more historical population figures become available, you can add them to the worksheet in column C. If you wish, you can extend the linear regression forecast, say, to the year 2010. Add the values 2001 to 2010 in range A55..A64, add the values 42 to 51 in range B55..B64, and assign the General format to these new values. Finally, copy the formula in cell D54 to range D55..D64. Do this only if you feel that the population increase will continue along a straight line.

SOURCES OF FORECASTS AND DATA

The standard reference source for population forecasts is *Projections of the Population of the United States, by Age, Sex, and Race: 1988 to 2080* (Series P-25, No. 1018, January 1989, U.S. Government Printing Office, Washington, DC 20402). This report explains the Bureau's assumptions and forecasting methodology and contains more than 100 pages of detailed tables. To obtain more detailed data on hard copy or in machine-readable form, write to the Data User Services Division, Customer Services, Bureau of the Census, Washington, DC 20233, or call 301-763-4100.

For each year in the analysis period, the bureau produces 30 forecasts with three basic series: high, middle, and low. The high and low forecasts are not the same thing as confidence limits; they simply reflect reasonable values. The middle series of forecasts was used in all comparisons in this article. The figures for past populations were taken from the *Statistical Abstract of the United States 1988*. ■

Everette S. Gardner Jr. is professor of decision and information sciences at the University of Houston, director of the International Institute of Forecasters, and coauthor of Quantitative Approaches to Management, *seventh edition (McGraw-Hill, 1989).*

HOW TO SET UP THE POPULATION-FORECAST WORKSHEET

1. Default setting

Format: Fixed 3

1-2-3: /Worksheet Global Format Fixed, enter 3
Symph: MENU Settings Format Fixed, enter 3, select Quit

2. Cell format

Format	Range
General	A14..B54

1-2-3: /Range Format General, specify range A14..B54
Symph: MENU Format General, specify range A14..B54

3. Labels

Enter the labels shown in cell A1 and in row 13 of figure 2. Right-align the labels in range A13..C13: Select /Range Label Right (*Symph:* MENU Range Label-Alignment Right) and specify range A13..C13.

4. Values

Enter the year numbers shown in column A in figure 2: Select /Data Fill (*Symph:* MENU Range Fill), specify range A14..A54 as the Fill range, enter 1960 as the start value, and press Return twice to accept the default step and stop values. Enter the X values in column B: Select /Data Fill (*Symph:* MENU Range Fill), press the Backspace key and specify range B14..B54 as the Fill range, enter 1 as the start value, and press Return twice to accept the default step and stop values. Finally, enter the values shown in range C14..C41 of figure 2.

5. Enter and copy formulas

Enter the formula +B14*C$10+D$4 in cell D14 and copy the cell to range D15..D54.

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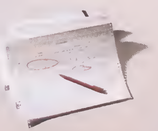

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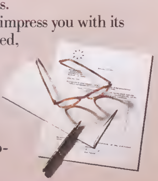

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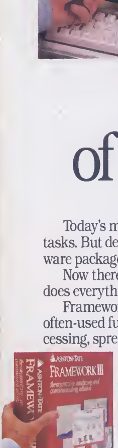

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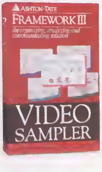

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MHS™ BY ACTION TECHNOLOGIES

CIRCLE 114 ON READER SERVICE CARD

LIFE INSURANCE ANALYZER

This model tells you if your current coverage is adequate.

BY STEPHEN L. NELSON

Ultimately, you must answer two questions regarding life insurance: How much do you need, and what type of policy is best for you? The worksheet described here helps you answer the first question. The box titled "Your Life Policy Options" outlines the advantages and disadvantages of the most common types of life insurance policies. It's up to you to weigh the relative merits of each type against your financial situation.

Be aware, however, that a wide variety of opinion exists on the topic. When contemplating any policy purchase, use several sources of information, including this worksheet, to get a balanced perspective on the plan that's right for you.

You can create this model in any version of *1-2-3* or *Symphony*. It's easy to use, and instructions on building it appear in the box on page 59.

HOW MUCH DO YOU NEED?

There are two traditional approaches to determining your life insurance requirements: the needs approach and the replacement-income approach. Each has its strong points and its drawbacks. The worksheet described combines these approaches, exploiting the advantages of each.

The needs approach requires that you total the financial needs of your family or estate. From this total you subtract any financial resources your estate can muster after your death. The difference represents the amount of life insurance you should have. Family needs might include paying off business or personal debt, putting children through college, supporting the family until children leave the nest, and paying estate or succession taxes.

While the simplicity of the needs approach is appealing, it has two shortcomings. For one, it is difficult to anticipate every financial need your survivors will encounter. In addition, it is often difficult to distinguish a need from a want. For example, is having your child attend an Ivy League college rather than a state university a need or a want?

The replacement-income approach assumes that the amount of life insurance you require is equivalent to the income you would have earned over a fixed period of time. This method has two strengths: It takes into account the effects of inflation, and it focuses on the big picture—your family's total financial requirements.

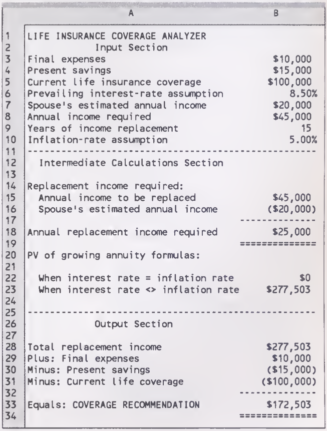
To determine the income that you need to replace with life insurance, you must follow these three steps:

1. Estimate the annual income your family requires and the number of years that income will be required.

2. Estimate the amount of that income that can be supplied annually by a spouse over that time period.

3. Calculate the difference, or annual shortfall, multiply it by the number of years you'll be insured, and take the present value by using reasonable inflation and interest-rate assumptions.

The problem with using the replacement-income approach is that the mathematics of the present-value formula are quite complex. Because of inflation, annual



	A	B
1	LIFE INSURANCE COVERAGE ANALYZER	
2	Input Section	
3	Final expenses	$10,000
4	Present savings	$15,000
5	Current life insurance coverage	$100,000
6	Prevailing interest-rate assumption	8.50%
7	Spouse's estimated annual income	$20,000
8	Annual income required	$45,000
9	Years of income replacement	15
10	Inflation-rate assumption	5.00%
11	--	-------------
12	Intermediate Calculations Section	
13		
14	Replacement income required:	
15	Annual income to be replaced	$45,000
16	Spouse's estimated annual income	($20,000)
17		-------------
18	Annual replacement income required	$25,000
19		=============
20	PV of growing annuity formulas:	
21		
22	When interest rate = inflation rate	$0
23	When interest rate <> inflation rate	$277,503
24		
25	--	-------------
26	Output Section	
27		
28	Total replacement income	$277,503
29	Plus: Final expenses	$10,000
30	Minus: Present savings	($15,000)
31	Minus: Current life coverage	($100,000)
32		-------------
33	Equals: COVERAGE RECOMMENDATION	$172,503
34		=============

Stephen L. Nelson is a contributing editor of LOTUS *and a consultant in Seattle.*

withdrawal amounts gradually get larger. These uneven cash flows preclude the use of the @PV financial function. However, the present-value formulas supplied in the worksheet solve that problem.

USING THE MODEL

The worksheet has three sections. The Input Section collects financial data. The Intermediate Calculations Section contains present-value formulas. The Output Section produces a final tally of the insurance coverage required.

You enter in the Input Section eight pieces of information: final expenses, present savings, current life insurance coverage, prevailing interest-rate assumption, spouse's estimated annual income, annual income required, years of income replacement, and an inflation-rate assumption. When making income-related entries, use average annual values.

Final expenses in cell B3 include any of the costs your family or estate incur as a result of your death that won't be covered by the income that's replaced. Examples include funeral and burial costs.

Present savings that your family can use to pay final expenses or that can go toward providing replacement income are entered in cell B4. Current life insurance coverage that's provided by your employer or that you have purchased for yourself is accounted for in cell B5. At some level of savings and current insurance coverage, you do not need additional life insurance. Your amassed wealth and insurance coverage provides your family with an adequate financial cushion. Worksheet formulas reflect this situation by returning negative insurance coverage values.

In the event of your death, the savings in cell B4 and any proceeds from current life insurance, plus the additional insurance that the model calculates is necessary, all earn interest. This interest is used to provide some of the replacement income. To calculate the interest earned on savings and insurance proceeds, you need to enter an interest rate in cell B6. Determine a realistic rate by checking with a local bank. Use the interest rates it pays on certificates of deposit. When choosing a rate, keep in mind that your funds are placed in low-risk investments.

You also need to account for income that can be provided by a working spouse. Enter an estimate of your spouse's average annual income over the years of replacement in cell B7.

A point to consider here is that when the breadwinner dies and the spouse is left with children under the age of 16, Social Security survivors' benefits can be substantial. You can obtain a Personalized Earnings and Benefits Statement from your local social security office. When you get this statement, include the indicated income in

YOUR LIFE POLICY OPTIONS

There are three basic types of life insurance. The simplest to understand and the least expensive is term life insurance. With term life you pay a premium to buy coverage for a finite period of time. If you die within that time period, the insurer pays your beneficiary the face amount of the policy. When the term is over, the insurance ends. If you want coverage for another term, you buy more insurance. Term insurance is relatively inexpensive for people under the age of 25. It is quite expensive for people over 50.

Whole life insurance adds a savings component to a term policy, but it costs between four and eight times as much as term insurance. A large portion of this cost is set aside in a savings account, called the cash-surrender value, which grows over a period of years.

Proponents of whole life cite two benefits. Whole life policies provide a forced savings program, and whole life premiums don't change over time. Critics of whole life point out several drawbacks, however. Because of the cost, it's often impossible to buy as much whole life insurance as you need. In addition, whole life policies must run for 20 or 30 years to provide investment returns that are comparable to certificates of deposit or other low-risk investments. For these reasons, many financial consultants recommend term policies over whole life insurance.

Universal life policies provide more flexibility than either term or whole life insurance. In a universal life policy, you might have the option of raising or lowering coverage limits. You might also be able to invest the savings portion of the policy in a money-market fund or a mutual fund. With some universal life policies you can even increase or decrease your premiums. Such flexibility means that as your insurance requirements change, you can easily adjust your insurance and investing plans.

How do you determine which type of life insurance is right for you? First, use the worksheet to calculate the coverage you need. Then determine the premium difference at that level of coverage among a term life policy, a whole life policy, and a universal life policy. There's a good chance you'll find that you can't afford anything but term insurance. If so, your insurance decision has been made for you.

If you can afford to cover yourself with whole life or universal life insurance, compare the savings that accrue with these types of policies with the returns you can get from other investments. If you've got the option of making a tax-deductible investment in a 401(k) plan or an IRA, it's likely that you can equal or better the return delivered by the investment component of a whole life or universal life policy. If so, you're better off purchasing term life insurance and investing the leftover funds in higher-yield investments.

your spouse's income entry in cell B7.

You also need to estimate the annual income required by your family and enter this amount in cell B8. As a rule, you can use 75% of your current family income.

The entry in cell B9, the number of years the replacement income is required, is harder to determine. It might be the number of years until a spouse returns to work, until a spouse becomes eligible for retirement benefits, or until the children are grown.

Keep in mind that life insurance requirements change. Use the worksheet to test different scenarios.

The final input you must provide is an estimate of the annual inflation rate over the years that the income will be replaced. If you calculate replacement income for short periods of time, say three years or less, inflation isn't an issue. Over longer time periods, however, inflation greatly affects the amount of insurance coverage a family needs. Take, for example, a family that needs $1,000 a month to live in 1989. If there's a 5% annual inflation rate, it will take $1,050 a month to maintain the same standard of living in 1990. By the year 2000, it will take $1,710 per month just to keep up with inflation.

The average rate of inflation for the past few years has been between 3% and 4%. Today, most financial planners use inflation estimates of 5%.

The model assumes that your family makes the withdrawals at the end of each year. If you want to restructure the model for monthly withdrawals, you can change all annual entries in range B6..B10 to monthly entries.

CALCULATIONS

The formula in cell B18 calculates the starting annual replacement income required. This is the difference between the annual income to be replaced in cell B15 and the income provided by a spouse in cell B16.

Formulas in either cell B22 or cell B23 calculate the present value of this amount. The worksheet uses an @IF function to choose between these present-value formulas. Why are two formulas required? Under certain conditions, namely when the interest rate equals the inflation rate, the denominator of the formula in cell B23 becomes zero. Since division by zero is impossible, a second, special-case formula is supplied in cell B22. This formula is designed to avoid the division-by-zero pitfall.

Each of these formulas calculates the present value of the replacement income required. If the interest rate you specified in cell B6 equals the inflation rate in cell B10, the formula in cell B22 performs the calculation. If the interest rate you specified doesn't equal the inflation rate, the formula in cell B23 crunches the numbers.

Formulas in the Output Section calculate the required amount of life insurance coverage. The @SUM formula in cell B33 takes the replacement income required, adds to it any final expenses, and subtracts from it both the current savings and the current life insurance amount. The result is an estimate of the total life insurance coverage required. A positive value in this cell indicates that you are underinsured. A negative value indicates that you are overinsured.

TIPS AND CAVEATS

Use the worksheet to test different scenarios and contingency plans. For example, enter a series of alternative values for such items as inflation rates, family-income levels, and spouse's income.

Keep in mind that you should not use this worksheet in a vacuum. Your spouse, your insurance agent, and your financial planner can provide useful input to the life insurance question. Remember, too, that life insurance requirements change. Save this worksheet and use it periodically to reevaluate your coverage requirements as your family and economic situations change. ■

HOW TO SET UP THE WORKSHEET FOR LIFE INSURANCE ANALYSIS

1. Individual column widths

Column	Width
A	38
B	14

For example, to set the width of column A, place the cell pointer in column A and select

1-2-3: /Worksheet Column Set-Width, enter 38
Symph: MENU Width Set, enter 38

2. Cell formats

Format	Range
Currency 0	B3..B5, B7..B8, B15..B33
Percent 2 (*Symph*: %2)	B6, B10

For example, to set the format of range B3..B5, select

1-2-3: /Range Format Currency, enter 0, indicate range B3..B5
Symph: MENU Format Currency, enter 0, indicate range B3..B5

3. Labels

Enter the labels shown in column A of the figure. Begin the entries in cells A2, A12, and A26 with a caret. Begin the entries in A15, A16, A22, and A23 with two blank spaces. To create the dashes and double dashes in rows 11, 17, 19, 25, 32, and 34, enter \- or \= in the appropriate cells.

4. Values

Enter the values shown in range B3..B10.

5. Formulas

Cell	Formula
B15	+B8
B16	−B7
B18	@SUM(B14.B17)
B22	@IF(B6=B10,(B9*B18)/(1+B6),0)
B23	@IF(B6<>B10,B18/(B6−B10)*(1−((1+B10)/(1+B6))^B9),0)
B28	+B22+B23
B29	+B3
B30	−B4
B31	−B5
B33	@SUM(B27..B32)

COMPUTER SAVVY IN THE B-SCHOOLS

The trend is to teach students how to use applications rather than how to program them.

BY EDWARD B. FISKE AND BRUCE HAMMOND

When first-year MBA students arrived for orientation week at the Massachusetts Institute of Technology's Sloan School of Management last fall, they expected the usual mix of welcoming receptions, lines, and forms to fill out. But soon after their arrival, all 200 of them were whisked away to a nearby hotel ballroom, where 75 personal computers were set up. Each machine was outfitted with specially designed software that allows students to assume the role of top management at People Express Airlines and run the company using their own strategies.

Prepared under the direction of MIT's Professor John Sterman, the program, *Management Flight Simulator*, is sophisticated enough to present a detailed scenario for up to five years beyond the actual five and a half years of the airline's existence, but simple enough to allow a computer novice to jump in with both feet. For the entire day, students implemented their own strategies for pricing, marketing, and growth and discovered how People Express failed and how it could have succeeded. "It looked like Mission Control at NASA, with 200 students all running People Express," says Sterman. "They loved it."

Sterman's *Management Flight Simulator* is a prime example of the power of computer technology to transform instruction at the nation's business schools. It is also indicative of the changing role that computers play in the business curriculum and of the changing skill requirements for business majors in the age of information.

THE PC'S RAPID INROADS

Computing—on mainframes—first entered the business curriculum in the early 1970s. But it was taught in the computer science department. And until the 1980s, microcomputers were virtually nonexistent in business schools. By the standards of academia, then, the integration of computing into the business school curriculum has proceeded with something like lightning speed. Jason Frand and Julia Britt, both of UCLA's Anderson Graduate School of Management, recently conducted a survey of computer usage in business schools and found that the schools average roughly 155 PCs, about one for every 40 students. And many schools have created their own introduction to business-information systems. Such courses tend to put heavy emphasis on problem solving with spreadsheet and database-management programs.

Frand and Britt found that in 1987 more than half the courses at the nation's better schools incorporated some use of the computer for purposes other than word processing. That includes accounting, where some feel computing has been indispensable for years. But it also includes areas such as marketing and organizational behavior, which traditionally have been less computer-oriented.

Even at the top schools, opinions differ as to the extent to which students should become skillful users of applications software. More important than technical proficiency, say many academics and executives, is a conceptual understanding of how such software can be used as an aid to decision making in the business world.

Computer instruction is now on the list of criteria for site examiners of the American Assembly of Collegiate Schools of Business, the accrediting agency for business schools. And Charles Hickman, the St. Louis agency's director of projects for Member Services, says that expectations for both student access to a computer and its integration into the curriculum are on the rise.

At most of the nation's 260 accredited graduate schools of business, students now spend as much time in the computer lab as they do in the library. Because of the pressure on lab facilities, a number of schools strongly

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recommend that their business students buy a personal computer.

Typical of such schools is the R. B. Pamplin College of Business at Virginia Tech, where purchase of a PC is "highly recommended." Broad integration of computers into the curriculum began three years ago and continues to progress. "In the future," says Associate Dean T. W. Bonham, "no matter what the class, there should be one significant assignment that is PC-oriented."

Still, computing in business schools has yet to transform the process of teaching and learning to the extent foreseen by analysts in the 1960s and '70s. For a myriad of reasons, the spread of computing through the business curriculum has been halting and uneven. The reasons include the huge expense involved in staying abreast of new generations of equipment, resistance by entrenched faculty members, and the difficulty of creating and hence slow development of relevant "courseware."

To a large extent, the integration of computers at business schools has mirrored that of corporate America, where computerization of information-oriented operations has been a fait accompli for years, but computing as a tool for management and strategy has been slower to take hold.

PREREQUISITE FOR A JOB

In today's highly competitive business environment, the days are gone when companies could survive with the computer as an executive paperweight. Even as marketplace pressures make extensive use of computers imperative, the potential costs of mistakes multiply. A case in point: *The Wall Street Journal* reported that several executives at a Dallas-based oil and gas company were fired in the wake of spreadsheet errors that cost the company millions of dollars in an acquisition deal.

To avoid such pitfalls, major corporations increasingly look to business schools to give their graduates a thorough conceptual and working knowledge of computers. Few, if any, are looking for specific training that could replace an on-site introduction to their own system and operating procedures. But almost all are seeking new hires with enough preparation to hit the ground running.

"No matter what their college major, we like to see graduates who are computer literate," says John Foley, manager of corporate employment and college relations for Xerox Corp. "Those who are computer literate are quicker learners when they get here."

And David Holcombe, a director of Information Technology Audit Services at Coopers & Lybrand, a Big Eight

PETER SIS

accounting firm, goes Foley one better. He says, "Within 10 years, graduates who do not have computer skills will have a hard time getting a job."

THE DECLINE OF PROGRAMMING

While almost everyone agrees that computer skills are important, there is debate over exactly what those skills should be for the typical student and how they should be taught. Coopers & Lybrand's Holcombe says, "The ability to move data around and to calculate that data isn't always as important as the need to understand what the business is going to use that information for."

Xerox's John Foley:
"We like to see graduates who are computer literate, no matter what their college major. They learn more quickly."

The old-style computer science course—featuring bits, bytes, and the basics of programming—still has some adherents who cite the benefits of the theoretical discipline required in learning a programming language, such as BASIC, Cobol, or Fortran. But even they concede that programming is valuable mainly for students in engineering, systems development, and other technology-related areas.

UCLA's Jason Frand and Julia Britt found that 70% of the schools they surveyed still include programming in their curricula. However, at many of the nation's most prestigious graduate schools of business and at many of the top undergraduate schools, programming has been eliminated as a requirement for general business students.

"Programming has become a pretty clumsy way of solving problems, given the flexibility of advanced software," says George Hettenhouse, associate dean for research and operations at Indiana University School of Business. "Corporations couldn't care less whether students can program." According to Hettenhouse, an Indiana University faculty committee is studying the idea of replacing Fortran with microcomputer business applications in the prerequisite computer course that business undergraduates take.

At the University of Texas at Austin, the story is much the same. "We used to teach programming in BASIC," says Rick Byars, a lecturer in the department of management science and information systems. "Finally, a couple of years ago we got enough PCs to change that. We replaced that course with an applications-software course."

Corporate recruiters are generally enthusiastic about the increased emphasis on problem solving and information management. In many cases, prodding from the business world was one of the primary catalysts for change at the schools.

The change, however, is far from universal. One professor estimates that as many as half of the nation's business schools still rely on programming as the primary introduction to computers.

At Ohio State University, the core computer course is a bone of contention because it still features Pascal programming, according to an administrator in the College of Business. Faculty members and a corporate advisory committee are lobbying hard for an approach more oriented toward problem solving. Part of the problem at OSU is that the core computer course is offered in the College of Engineering. The emphasis there is on programming and languages rather than on applications relevant to business.

The computer courses that many business schools are now developing fall under the rubric "management of information systems," or MIS. Instead of tracing the logic of programming, these courses emphasize the computer's potential for generating, accessing, and managing information, which in turn can be used to transform both day-to-day practices and long-term corporate strategy.

One course priority is to communicate the capabilities of various software tools, such as the spreadsheet, and how to use them to create conceptually sound models for solving real-world business problems. Arthur Schreiber, associate dean of the College of Business Administration at Georgia State University, says, "Of greatest importance to us is producing graduates who are able to use this stuff themselves and who are, at the same time, also able to relate to systems professionals."

The decline of programming instruction has given rise to a second, and equally intriguing, curricular issue: Should computer literacy be taught as a separate subject at all? In many undergraduate business programs, a major part of the introduction to information systems is a functional, not theoretical, approach to hardware, operating systems, and key applications software. But other schools believe that without the theoretical rigor of a computer language, computer literacy lacks the intellectual substance necessary to be a bona fide discipline offered as part of the curriculum.

PHIL MATT

A SINK-OR-SWIM APPROACH

Many graduate schools assume that students will already have had an introduction to basic software before enrollment. This is not an unreasonable assumption when you consider that a typical student has worked several years in the private sector. As for those who do not have prior experience, the assumption is that they will "learn by doing" within the context of their normal course load.

"We do not offer any courses in computer skills for academic credit," says Roland Minch, professor of accounting at the State University of New York at Albany. "We put that in the category of learning how to type." After a few extra sessions at the beginning of the semester for those who need help, Minch says, undergraduates and MBA students alike are left to "learn in the school of hard knocks."

Harvard's Frayda Galvin:
"Probably 90% of our students come with at least an adequate knowledge of word processing and spreadsheets."

Most of the nation's leading graduate schools of business have adopted a similar approach. At Dartmouth's Amos Tuck School of Business Administration, students can take a six-week course in computer skills. The University of Pennsylvania's Wharton School offers an optional three-week primer, as well as other noncredit courses.

Harvard mails its students a computer package the summer before they enroll. Students are expected to have mastered the rudiments of both hardware and software by the time they arrive in the fall. Those who need further help can attend noncredit review sessions, but only about a tenth of each entering class does, and many of them are foreign students who have had limited access to computers.

"Probably 90% of our students come with at least an adequate knowledge of word processing and spreadsheets," says Frayda Galvin, assistant director of academic computing support at the business school. Former Harvard B-school student Guilliaume D'hauteville notes, "If you have a problem with computers, you should not be at business school."

At the other end of the spectrum is West Virginia University. It requires a two-term introduction to computers and information systems for all undergraduate business majors and a one-term course for MBA students.

Professor Michael Wolfe, who teaches both, believes that PC applications software, particularly the spreadsheet, is an important core topic. "I maintain that I am teaching abstract and theoretical concepts without letting a lot of old baggage get in the way," he says. Wolfe contends that the sentiment against teaching applications is largely generational. As younger academics assert themselves, he believes, an increasing number of universities will include applications in their curricula.

At the undergraduate level, most business schools adopt a policy somewhere between leaving their entering students to learn computer skills on their own and requiring several introductory courses. That means that colleges typically require a one-semester introduction to either programming or software that includes the basics of computer use.

As yet, there is no evidence that a more intensive computing environment for general business students translates into more favorable ratings from corporate recruiters. David Holcombe of Coopers & Lybrand says business schools are beginning to be evaluated "somewhat" on the computer skills of their graduates. But he cautions that even the most technically oriented employers are looking for new hires that have more than just computer wizardry. Bob Foster, general manager of systems and computer services at Tenneco Oil Exploration and Production in Houston, agrees. "I'd rather have people who are going to be well-rounded corporate citizens," he says, "than technical people who have a very narrow and deep understanding of a particular area."

TECH SCHOOLS LEAD THE WAY

Some business schools, notably those at technically oriented universities such as MIT, Rensselaer Polytechnic Institute, and Carnegie-Mellon University, have long-standing reputations for turning out computer-savvy graduates. Such institutions tend to attract more technically oriented students because they provide more sophisticated and extensive computer facilities and a culture that is receptive to technical innovation. But the growing importance of computing in business instruction is helping to propel less-prestigious schools, many of them land-grant state universities with strong traditions in engineering, into the forefront of computer problem solving.

A good example is Virginia Tech, which recently installed a $16 million communications system that links the university's 8,500 dorm residents with a university-wide data, voice, and video communications network.

MICHAEL ROMANOS

GETTING MORE PCs INTO STUDENTS' HANDS

New approaches to teaching problem solving with computers won't get very far if students don't have access to hardware and software. And that has been a problem on many campuses.

At many business schools, especially the larger ones, computer resources are strained to the limit. At the University of Texas, total business enrollment is about 10,000, and 1,000 undergraduates each term crowd into the introductory computing course. Yet only about 300 PCs are earmarked for use by business students. Though UT's ratio of 1 computer to every 33 students is slightly better than the national average, it still "leaves us short during crunch times," says UT lecturer Rick Byars.

At many schools, part of the difficulty lies in the role of the business school as a money-making enterprise. "Business schools have traditionally been cash cows," says Charles Hickman, project director for the American Assembly of Collegiate Schools of Business. "Many universities are just not accustomed to substantial capital outlays for their business schools."

> **Just as nettlesome as the problem of keeping hardware up to date is the problem of procuring and disseminating up-to-date software.**

The financial squeeze has been eased somewhat for some schools by grants from computer manufacturers. According to Jason Frand of UCLA's Anderson Graduate School of Management, every piece of hardware in use at Anderson was donated by a private company.

But only a small minority of schools get such extensive private support, and those that do not are often the ones that need it the most. Hickman fears that the increasing need for expensive equipment "may widen the gap between the haves and the have nots."

Bring your own

A growing number of universities either require or strongly recommend that their students buy a PC. But strategies differ regarding which technology to recommend. At the undergraduate level, many universities recommend relatively modest machines having about 640K of memory, with or without a 20-megabyte hard-disk drive. One such school, Virginia Tech, recommends that students buy an MS-DOS–compatible machine and a dot-matrix printer, for a minimum price tag of $1,200. About 80% of the students participate.

Other universities, including some of the nation's elite graduate schools of business, have opted for pricier models. At Harvard, students are required to buy a fully integrated package that includes the Zenith SupersPort 286 laptop outfitted with 1 megabyte of memory and a 20-megabyte hard-disk drive. Along with a printer and specially designed software, the package sells for about $2,800 and is intended to fulfill most of the student's computing needs.

But many universities are loath to require purchase of a particular model. The reasons include academic freedom, the risk of alienating faculty who use another system, and the fear of speedy obsolescence. "If students feel they were required to buy a dinosaur," says David Weber, director of student services at MIT's Sloan School of Management, "we'll have some dissatisfied alumni."

In recent years many universities have become convinced that maintaining a multivendor environment makes for a well-rounded education and keeps the door open to ventures with a variety of companies. Stanford, among the first to adopt such an approach, maintains IBM, Hewlett-Packard, Macintosh, and Epson personal computers, as well as three DEC MicroVAX workstations. "There is no single model that we think is best," says Jim Patell, associate dean of the business school. "We prefer to let students experiment."

In line with usage in the corporate world, MS-DOS is the dominant operating system and is used by 100% of the schools in the UCLA survey. But Macintosh machines, present at only 13% of the schools in 1985, were available at 29% by 1988. MIT's Weber notes that Mac users now "feel a lot more comfortable telling others they prefer a Mac." Use of laptops has also grown rapidly.

Affordable software

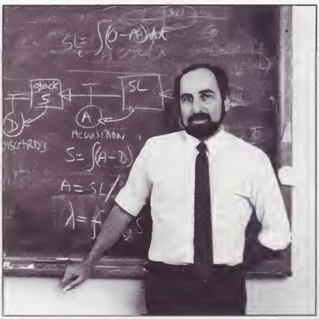
Just as nettlesome as the problem of keeping hardware up to date is the problem of procuring and disseminating up-to-date software. Most universities don't have the money to buy copies of expensive programs for every student, and the threat of lawsuits from software companies for complicity in illegal copying means that the college-owned software is frequently kept under wraps. "Someday, somebody's going to go to court about that, and we don't want it to be us," says George Hettenhouse, associate dean at Indiana University's School of Business. "We try to be ethical."

To get around the copyright bottleneck, many software companies, including Lotus Development Corp., have begun to offer students cheaper versions of their programs, as well as network copies that allow large-scale use at a reasonable cost. The successful software companies have discovered that the more people who use their products as students, the more business they will have later on.

From their rooms, students have access to the campus mainframe, library card catalogues, more than 30 bulletin boards, and a 64-station cable-TV network that offers everything from live broadcasts of economics classes and math help sessions to The Weather Channel.

According to Virginia Tech's Associate Dean Bonham, the business school is the beneficiary of the university's prevailing technical bent. "When you look at the leading schools that are doing this stuff, they're primarily technical schools," he says. "You're not going to find a liberal arts school that is moving that quickly."

Georgia State University, a commuter school in Atlanta, has capitalized on its location near high-tech employers such as Lockheed Corp. and IBM Corp. to become one of the nation's leaders in the development and implementation of computer applications for business schools. The business school boasts 19 tenured or tenure-track positions in its Computer Information Systems Department, including nationally known professors such as Ephraim McLean, whom Georgia State recently lured away from UCLA by offering him an endowed chair. Georgia State is one of an elite group of 13 universities to receive a recent $2 million grant from IBM to develop instruction in information systems.



MIT's John Sterman:
"Enrollment quadrupled when I began using Management Flight Simulator *in my system dynamics course."*

THE DEARTH OF SOFTWARE

As business schools place increasing emphasis on the computer as a decision-making tool, they have to wrestle with some other issues unrelated to educational philosophy. One is the accessibility of hardware and standard, legally acquired software to students (see the "Getting More PCs" box). A second is faculty acceptance. And a third is the availability of subject-specific software.

One of the biggest stumbling blocks in the way of microcomputer integration has been the reluctance of faculty to change years of teaching practice. Many professors, especially older ones in areas that are less technology-intensive, are understandably intimidated by the thought of teaching microcomputer applications to students who knew more about the machines when they were 16 than the professors ever will. "There are faculty members who prefer to pretend that [computers] don't exist," says Marjorie Brundage, Ohio State University's director of computer services for the College of Business.

Just as inhibiting has been the lack of subject-specific software. Faculties publish books and articles by the dozen, largely because they are the main determinant of both tenure decisions and recognition in the profession. But there is little incentive, financial or otherwise, for faculty members to engage in the time-consuming process of writing instructional software.

"I think the development of software tends to fit into the category of textbooks," says Georgia State's Schreiber. "You get some credit for it, but it's not going to get you tenure at a research university." A number of computer-industry leaders have made available faculty grants for software development, but any time spent on it is still considered a diversion from scholarly pursuits.

Despite the impediments, innovative courseware is beginning to have an impact on business curricula, and the most fertile area of development is in programs like John Sterman's *Management Flight Simulator*. Sterman reports that since he began using simulation software in his system dynamics course at the Sloan School, enrollment in the course has quadrupled. The *Management Flight Simulator* makes use of the gaming program *MicroWorld Explorer*, designed by MicroWorlds (Cambridge, Mass.). The model for *Flight Simulator* was developed by using *Stella* (Systems Thinking Experiential Learning Laboratory with Animation).

Stella, a Macintosh-based simulation program, is used at some top schools, including Dartmouth and the University of Southern California. It creates a matrix of intertwined variables that mimic reality in response to the student's decisions. "It compresses space and time in a realistic way so that people can see the ramifications of their decisions," says Barry Richmond, president of High Performance Systems (Lyme, N.H.), *Stella's* creator.

Though no one can predict the future course of technology in the business world or in business schools, few doubt that the 1990s will be every bit as dynamic as the '80s. That's why educators and executives alike believe that the most important technical preparation may be a conceptual understanding of how computers can reorder and revolutionize work processes.

"We try to educate the students, not just train them," says Virginia Tech's Bonham. "If we do a good job, they'll be able to keep up with technology." ■

MICHAEL ROMANOS

Why 1-2-3 users are d
computers for the se

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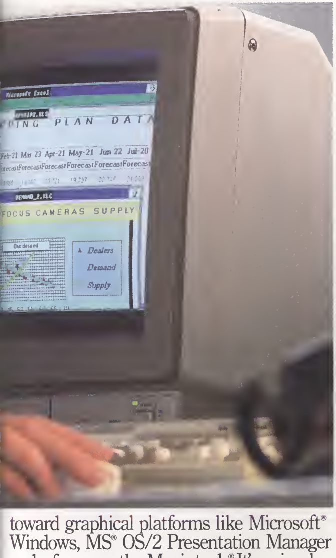
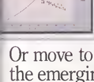


toward graphical platforms like Microsoft® Windows, MS® OS/2 Presentation Manager and, of course, the Macintosh.® It's a simple reality. Which means serious spreadsheet users are suddenly faced with a decision.



Stay with 1-2-3, the current character-based standard. Or move to Microsoft® Excel for Windows, the emerging standard designed expressly for graphical environments. Graphical as in the simplest, most visual way to harness the power of the 286/386 machines—which in turn lets you easily tap all the power and glory of the spreadsheet.

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Where Did I Stash That Worksheet?

Build an instant index to help you find all of them.

BY GLEN L. DAKE

The longer you work with worksheets, the more applications you are likely to build and use. Finding the worksheet you want among the many you've created is difficult when you must search through a list of cryptic file names each time you want to retrieve a file. In *1-2-3* after pressing slash and selecting File Retrieve, you can press the NAME key to view an expanded list of the worksheet files in your current directory. To get the same results in *Symphony*, you select SERVICES File Retrieve and then press the SERVICES or MENU key. Even though having the list is helpful, it's difficult to differentiate one worksheet from another with only the file names as clues.

The index worksheet described here provides a solution. It allows you to display a lengthy description along with each worksheet's file name. It also provides a macro that automatically retrieves a file when you highlight the file name with the cell pointer and press Return. Building the worksheet offers yet another benefit—an easy-to-understand introduction to the versatile @CELLPOINTER function and to the macro {LET} statement.

The hardest part of creating an index is collecting and entering your *1-2-3* and *Symphony* worksheet file names. With the techniques used in this article, even that chore is a snap. You let DOS do most of the work for you. In *1-2-3* Releases 2.2 and 3, the /File Admin Table command does all the work. Keeping the index up-to-date is easy if you add names and descriptions to it as you build and save new worksheets.

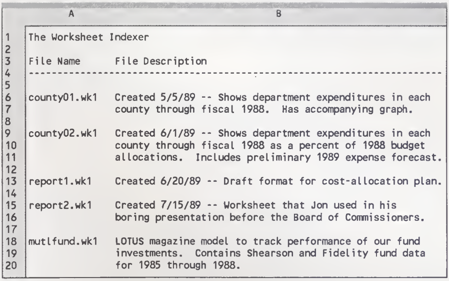
Once you build the index worksheet, save it with a name that will appear at the beginning of the list of file names produced by the File Retrieve command. That way, no matter how many worksheet files are in a subdirectory, you can always quickly locate your index.

This index system is designed for use on a hard disk, and it retrieves worksheet files from the current directory. If you store *1-2-3* or *Symphony* worksheet files in several subdirectories, you need to create an index worksheet for each one. The index works in *1-2-3* Releases

---

Glen L. Dake is a financial analyst for the Washington State Department of Natural Resources in Olympia, Wash.

PHILIP ANDERSON



```
            A                                  B

1   The Worksheet Indexer
2
3   File Name      File Description
4   ------------------------------------------------------------------
5
6   county01.wk1   Created 5/5/89 -- Shows department expenditures in each
7                  county through fiscal 1988.  Has accompanying graph.
8
9   county02.wk1   Created 6/1/89 -- Shows department expenditures in each
10                 county through fiscal 1988 as a percent of 1988 budget
11                 allocations.  Includes preliminary 1989 expense forecast.
12
13  report1.wk1    Created 6/20/89 -- Draft format for cost-allocation plan.
14
15  report2.wk1    Created 7/15/89 -- Worksheet that Jon used in his
16                 boring presentation before the Board of Commissioners.
17
18  mutlfund.wk1   LOTUS magazine model to track performance of our fund
19                 investments.  Contains Shearson and Fidelity fund data
20                 for 1985 through 1988.
```

This indexing worksheet helps you find and retrieve files in two ways: It allows you to append lengthy comments and descriptions to file names, and it provides a macro that automatically retrieves a highlighted file, so you don't have to enter individual file names. File names are listed in column A and file descriptions in column B.

2/2.01, 2.2, and 3 and with all versions of *Symphony*.

HOW IT WORKS

Instructions for building the index worksheet appear in the box on the right. A hypothetical worksheet index appears in the top figure. Column A contains a list of file names and extensions. Column B contains long labels that describe the contents or the purpose of the files listed in column A. You can use as many rows as necessary in column B to describe files. Skipping a row between entries makes the comments in column B easier to read.

To keep file names and comments within the width of a single screen, limit the length of each comment line to 57 characters. If you're concerned about saving disk space and RAM, you need not skip a row between entries. Use the PageUp and PageDown keys to move quickly through long lists of file names.

HOW TO SET UP THE INDEX WORKSHEET

1. Individual column widths

Column	**Width**
A	14
B	57

For example, to set the width of column A, place the cell pointer in column A and select

1-2-3: /Worksheet Column Set-Width, enter 14

Symph: MENU Width Set, enter 14

2.Labels

Enter the labels shown in the figure and in the macro screen. Be sure to precede the labels in cells J3 and K4 with label prefixes. To create the row of dashes, enter \– in cell A4 and copy cell A4 to cell B4. In *Symphony* enter the label {SERVICES}FR{*filename*}~ to replace the label in cell K4.

3. Range names

Name	**Range**
filename	K1
\r	K3

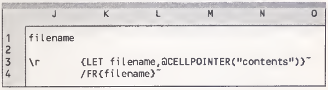
To assign these range names, press slash (*Symph:* MENU), select Range Name Labels Right, and indicate J1..J3 as the range.

4. Save the worksheet

Save the worksheet in the directory that contains your *1-2-3* or *Symphony* worksheet files. When prompted for the file name, enter *00-index*.

You retrieve a file by placing the cell pointer in the cell in column A that contains the name of the file you want. When you start the macro by holding down the MACRO key (Alt on most computers) and pressing R, *1-2-3* and *Symphony* retrieve the file whose name is in the cell where the cell pointer resides. The spelling of a file name in the worksheet and on the hard disk must be identical. Otherwise, *1-2-3* and *Symphony* will not be able to locate the file. Whether the file name on the worksheet list is in uppercase or lowercase doesn't affect the process.

The macro that drives the file-retrieval operation appears in the screen to the right. It uses a {LET} statement in conjunction with the @CELLPOINTER function to supply a file name to a File Retrieve command. The @CELLPOINTER function returns the character string in the cell that is highlighted by the pointer. A {LET} statement stores the string that is returned in the cell named *filename* (cell K1). The File Retrieve command in cell K4 uses the string stored in cell K1 as the file name.



```
        J         K         L         M         N         O

1   filename
2
3   \r        {LET filename,@CELLPOINTER("contents")}~
4             /FR{filename}~
```

A {LET} statement is an advanced macro command that stores a cell entry in a specified cell location. The {LET} statement in this macro takes two arguments: *location* and *string*. Cell K1, named *filename*, is the location argument. The second argument is a string of characters returned by an @CELLPOINTER function.

Depending on its argument, @CELLPOINTER returns a variety of information about the cell in which the pointer

Naming this worksheet 00-INDEX ensures that it is easy to find.

is located. It can return a cell's address, contents, format, width, label prefix, row number, column number, and more. In this macro, @CELLPOINTER("contents") returns the characters entered in the current cell. When you place the cell pointer in a cell containing a file name, you get the file name.

The second line of the macro instructs *1-2-3* and *Symphony* to retrieve a file. The macro looks in the range named *filename* for the name of the file to retrieve.

USING THE INDEX

Before you use the worksheet, save it. If you don't, it erases itself the first time you use it to retrieve a file. When you save the index worksheet, name it 00-INDEX. *1-2-3* and *Symphony* list worksheet files in the current directory in numerical, then alphabetical, order. Naming this worksheet 00-INDEX ensures that it will appear at or near the beginning of the list of worksheet files. This enables you to locate it quickly at the beginning of a work session.

After you save the index worksheet, test the macro. Place the cell pointer on a file name in column A and press MACRO-R. *1-2-3* and *Symphony* attempt to retrieve the file. If you placed the cell pointer in a cell containing one of the file names in the figure, you're likely to see the error message *File does not exist.* This means that the macro is working and that no file with the name you highlighted exists. Press the Escape key to clear the error condition.

You should not see any other error messages. If you do, double-check the macro instructions in cells K3 and K4. Be sure to use braces ({ }) where indicated and to end each entry with a tilde (~). Also check to see if you made the range-name assignments in column K correctly.

When you're sure the macro is working properly, enter in column A the file name of a worksheet in your current directory. Be sure it's spelled correctly. Place the cell pointer on the cell containing the name and then press MACRO-R. The program should load the file. Retrieve the index worksheet and replace the entries in the figure with your own file names and descriptions. The box entitled "Easy Ways to Import File Names" describes techniques for importing worksheet file names into the index worksheet.

Once your file names and descriptions are complete, save the index worksheet by pressing slash (in *Symphony*, SERVICES), selecting File Save, and entering *00-index*. Keep the index current by updating it regularly as you save and delete worksheets. Back up the index on a floppy disk in case something happens to the original. ■

EASY WAYS TO IMPORT FILE NAMES

In *1-2-3* Releases 2.2 and 3, you can use the File Admin Table Worksheet command to bring into the current worksheet a list of worksheet file names that are in a particular directory. This command brings additional information into the worksheet—date, time, and file size. You can easily delete this information because it is broken into separate columns.

If you use older versions of *1-2-3* or any version of *Symphony*, here's an easy way to get all your file names into the index worksheet. Rather than manually enter each name, use the DOS DIR command and the DOS piping feature to create an ASCII file that contains the names of your worksheets. Then import this ASCII file into the index worksheet.

Follow these 10 steps to create the list of file names for the index worksheet:

1. Determine which subdirectory holds the worksheet files you want to index. Determine the file extension of those files (.WK1, .WR1, and so on).

2. Make the directory containing the worksheet files you want the current directory by typing *cd*, a character space, and the directory name. At the DOS prompt enter the following command:

```
dir *.wk1>list.prn
```

This command instructs DOS to list and save to an ASCII file named LIST.PRN all the files in the current directory that have the .WK1 file-name extension.

3. Load *1-2-3* or *Symphony* and retrieve the file named 00-INDEX.

4. Place the cell pointer in cell A5.

5. In *1-2-3* press slash (in *Symphony*, SERVICES) and select File Import Text. Select LIST.PRN and press Return.

6. Enter the formula @LEFT(A9,@FIND(" ",A9,0)) in cell B9. This formula returns the file name from the directory listing.

7. Copy this formula from cell B9 to cell B10, copying it down as many rows as there are file names.

8. With the cell pointer in cell B9, select /Range Value (in *Symphony*, MENU Range Values) and indicate the range of file names in column B as the range to copy from. Enter cell A9 as the range to copy to. Erase the file names in column B.

9. Delete rows 6 and 7, which contain additional DOS-directory information. Also delete another row at the bottom of the list of file names.

10. Provide comments in column B for each file name. Insert rows as necessary to provide adequate space for comments.

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FORMULAS

SPECIAL REPORT

Although macros get the glory, the real heroes of any spreadsheet are its formulas.

Whether you're a novice or a power user, you'll find in this section useful insights into how to make your *1-2-3* and *Symphony* formulas work harder.

74 BASIC WORKSHEET MATH
The operators that make formulas tick

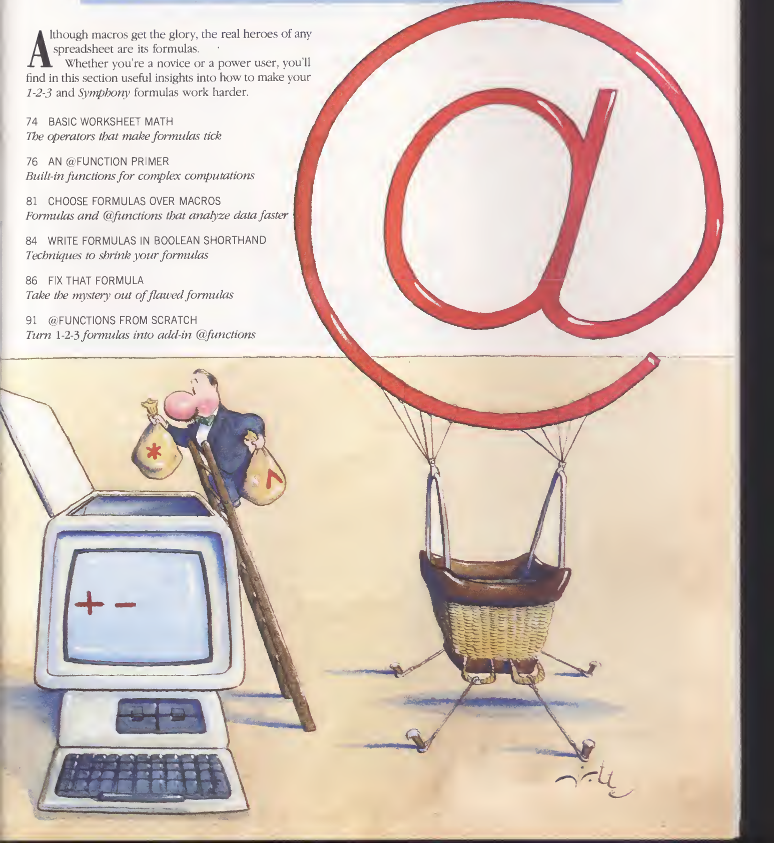
76 AN @FUNCTION PRIMER
Built-in functions for complex computations

81 CHOOSE FORMULAS OVER MACROS
Formulas and @functions that analyze data faster

84 WRITE FORMULAS IN BOOLEAN SHORTHAND
Techniques to shrink your formulas

86 FIX THAT FORMULA
Take the mystery out of flawed formulas

91 @FUNCTIONS FROM SCRATCH
Turn 1-2-3 *formulas into add-in @functions*



BASIC WORKSHEET MATH

Learn about the well-known and lesser-known operators that make formulas tick.

BY ROBERT HILDEBRAND

Every formula you encounter, whether you solve it with pencil and paper, a calculator, or your spreadsheet, has two parts: the values you want to manipulate, and the operators, which specify the kind of calculation you want.

Even if you feel you know as much as you need to about performing math in *1-2-3* and *Symphony*, you will very likely find this article useful. It explains how operators work in combinations and introduces some operators you may not know about.

The Basic Operators

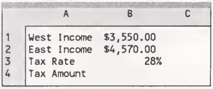
Most formulas use one or more of the four basic mathematical operators: + (plus), − (minus), / (divided by), and * (the symbol that in many computer languages means "multiplied by"). For example, it's no surprise that if you enter the formula 3+7 in a cell, it returns 10. If you enter +A5−4 in a cell, and cell A5 contains the value 100, the formula returns 96. The formula +B8/C10 divides the value in cell B8 by the value in cell C10. The formula +D50*days multiplies the value in cell D50 by the value in a cell that's been assigned the name *days.*

Another basic mathematical operation is exponentiation, which you use to raise a number to a power. Raising a number to the *n*th power is like writing that number *n* times and putting multiplication symbols between the numbers. Normally the exponent, the power to which you're raising the number, is written as a superscript after the base number. In normal notation, 3 to the second power is written as 3^2. *1-2-3*, *Symphony*, and many other computer programs use the caret (^) to represent exponentiation. In spreadsheet notation, 3 to the second power is written as 3^2.

Here are some examples: 3^2 (3^2), also called 3 squared, is equivalent to 3*3, or 9. And 2^3 (2^3), also called 2 cubed, is equivalent to 2*2*2, or 8. Likewise, 10^4 (10^4) is equivalent to 10*10*10*10, or 10,000.

Combining Operators

Most formulas involve more than just two pieces of data. Consider this spreadsheet:



```
        A             B         C
1 West Income  $3,550.00
2 East Income  $4,570.00
3 Tax Rate           28%
4 Tax Amount
```

To calculate the taxes due on the East and West incomes, you add the two incomes and multiply that sum by the tax rate. You might be tempted to enter the formula +B1+B2*B3 in cell B4. This formula would return $4,829.60. That's a lot of tax for an income of $8,120. What happened?

The above formula has two operations—addition and multiplication. When *1-2-3* and *Symphony* evaluate formulas containing more than one operation, they follow a standard system for determining the order in which to do calculations. This system is called the rules of operator precedence. Certain operations take precedence over others, meaning that they are performed before the others. The five operators we have looked at so far are assigned these precedence values by *1-2-3* and *Symphony*:

Operation	Operator	Precedence
to the power of	^	7
multiplied by or divided by	* or /	5
plus or minus	+ or −	4

Don't worry about why the exponentiation operator (^) is assigned a precedence value of 7 and why 6 is not listed. We'll get to that later. Just note that the exponentiation operator has a higher precedence value than the operators for multiplication and division, which in turn have a higher precedence value than the operators for addition and subtraction. An operation with a higher precedence value is performed before one with a lower precedence value, and operations of equal precedence are performed from left to right.

You can now see why the formula +B1+B2*B3 indicated such an outrageous tax amount. The multiplication was performed first, since it has a higher precedence than addition. The formula 3,550+4,570*28% computes 28% of 4,570. It then adds the result, 1,279.6, to 3,550, yielding 4,829.6.

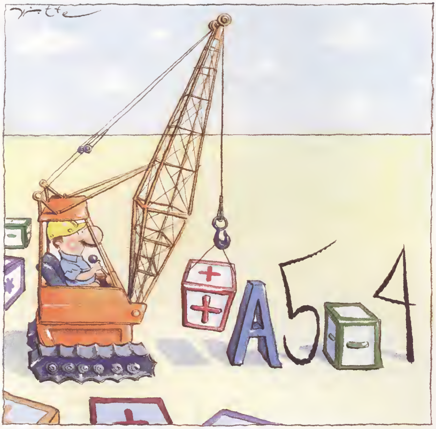
You must make the formula override the natural precedence and perform the addition before the multiplication. You do this with parentheses. When *1-2-3* and *Symphony* evaluate formulas, they perform all operations within parentheses before performing other operations. Thus, the formula in cell B4 should read (B1+B2)*B3. The program sees the parentheses and performs the addition first, so the formula (3,550+4,570)*28% becomes 8,120*28%, which in turn becomes 2,273.6. That's a more reasonable tax amount.

In more-complicated formulas, you can nest parentheses. The innermost parenthetical operations are performed first. Take a look at this formula:

$$3\hat{}(4*(5-2))+7$$

To solve it, begin with the subtraction 5−2 to get 3. Then multiply 4*3 to get 12, then raise 3 to the 12th power to get 531,441, then add 7 to 531,441 to get 531,448. This diagram shows how *1-2-3* and *Symphony* process this formula:

$$\begin{gathered}3\hat{}(4*(\underbrace{5-2}))+7\\ 3\hat{}(\underbrace{4*3})+7\\ \underbrace{3\hat{}12}+7\\ \underbrace{531{,}441+7}\\ 531{,}448\end{gathered}$$



If you omit the outer set of parentheses, you get a different result:

$$
\begin{gathered}
3{\wedge}4*(5\underbrace{-}2)+7\\
\underbrace{3{\wedge}4}*3+7\\
81\underbrace{*}3+7\\
243\underbrace{+}7\\
250
\end{gathered}
$$

If you omit all the parentheses, you get a third result:

$$
\begin{gathered}
\underbrace{3{\wedge}4}*5-2+7\\
81\underbrace{*}5-2+7\\
405\underbrace{-}2+7\\
403\underbrace{+}7\\
410
\end{gathered}
$$

Which of these formulas is correct? That depends on what you want the formula to accomplish. You use parentheses to make a formula duplicate the process you'd use if you did the math manually. If you were figuring the taxes on the income from two divisions, you'd add the income amounts first, then multiply the result by the tax rate. The formula (B1+B2)*B3 uses parentheses to make *1-2-3* and *Symphony* do the same.

On the other hand, when billing a customer for both taxable and nontaxable items, assuming a 5% sales tax, you first multiply the taxable items by 1.05 and then add the nontaxable items. Now consider preparing such a bill using your spreadsheet. If the totals of taxable and nontaxable items are in cells named *taxable* and *nontax*, and if the value 1.05 is in a cell named *taxrate*, you compute the total with the formula:

+taxable*taxrate+nontax

Since multiplication takes precedence over addition, you don't need to include parentheses in this formula.

When parentheses aren't required, you may choose to include them anyway to make the formula easier to read. If you want the above formula to be a bit clearer, you can enter it the following way:

(taxable*taxrate)+nontax

Logical Operators

The operators we've considered so far are arithmetic operators. Logical operators are the other type you can use in *1-2-3* and *Symphony* formulas. We'll look at these in brief to show how they fit into the complete list of operators. For a fuller discussion of expressions using logical operators, see the article "Write Your Formulas in Boolean Shorthand" in this special report.

You use logical operators in expressions that make comparisons. For example, you may need a formula to return the value 1,000 only if the value in cell A1 is exactly equal to the value in cell B1. The formula @IF(A1=B1,1000,0) does just that. The equal-to operator (=) makes the program test for the equality of cells A1 and B1.

If you want the formula to return 1,000 only if the value in cell A1 is less than the value in cell B1, replace the equal-to operator with the less-than symbol (<). The formula @IF(A1<B1,1000,0) would accomplish this.

The following table lists the six operators you can use for comparing values:

Operator	**Meaning**
=	equal to
<>	not equal to
>	greater than
<	less than
>=	greater than or equal to
<=	less than or equal to

Two other operators allow you to perform multiple comparisons in one formula: #AND# and #OR#. To see how these work, consider the following:

@IF(A1=B1#AND#C1<D1,1000,0)

This formula evaluates the expressions A1=B1 and C1<D1. Then it considers whether both of those tests are true. If they are, the formula returns 1,000. If either test is false, the formula returns 0.

In the following formula, only one of the tests needs to be true for the formula

MICHAEL WITTE

to return 1,000. Only if both tests are false will the formula return 0.

@IF(A1=B1#OR#C1<D1,1000,0)

Finally, there's the operator #NOT#, which simply makes a true expression false and vice versa. For example, the following formula returns 1,000 if cell A1 isn't equal to cell B1:

@IF(#NOT#A1=B1,1000,0)

Now that we've examined all the mathematical operators used by *1-2-3* and *Symphony*, we'll finish with a look at the complete list of operators, arranged in order of precedence.

Operator	Operation	Precedence
^	to the power of	7
+ −	positive, negative	6
* /	multiplied by, divided by	5
+ −	plus, minus	4
= <>	equal to, not equal to	3
< >	less than, greater than	3
<= >=	less than or equal to, greater than or equal to	3
#NOT#	logical NOT	2
#AND#	logical AND	1
#OR#	logical OR	1

Notice that the symbols + and − appear twice, with different precedence values. That's because these operators can have two meanings in a formula. When the operators indicate addition or subtraction, their precedence value is 4. But when these operators indicate that a value is positive or negative, they have a precedence of 6. For example, in the formula +3*−6, the minus sign doesn't mean subtraction; it means that the formula is dealing with the number −6. And the plus sign doesn't indicate addition; it means that the formula is dealing with the number +3, or 3. Those evaluations are done before the multiplication in the formula, in accordance with those operators' positions in the precedence table. ■

Robert Hildebrand wrote about lookup tables in the April 1988 issue of LOTUS.

AN @FUNCTION PRIMER

A host of built-in formulas handles complex computations and more.

BY PAULA DEMPSEY

1-2-3 and *Symphony* each provide a variety of built-in formulas called @functions ("at" functions). You use these @functions to perform specialized calculations and other worksheet tasks in a jiffy. Many @functions solve a particular problem, such as calculating depreciation, standard deviation, or a square root. Others can look up an item in a table, convert a label to a value, or return the characters in a string.

There are seven categories of @functions: financial, statistical, string, date and time, special, logical, and mathematical. This article discusses each category and provides examples of how you can put these functions to work. If you need @functions that are not available in *1-2-3* or *Symphony*, you can buy commercially available add-in @function libraries. The box on page 80 lists eight of these products.

The Ground Rules

All @functions start with an at sign (@), which is followed by the function's name. Most @functions also require "arguments," which are enclosed by parentheses and separated by commas. The @PMT function, for example, requires three arguments: *principal, interest rate*, and *term*. It is written as @PMT(*principal,interest rate,term*).

Most functions accept the following three types of arguments: numeric values, ranges, and strings. Numeric values in an argument can be positive or negative. Values can be expressed as whole numbers or as decimal numbers.

A range argument can refer to a single cell or to a group of contiguous cells. To specify a range argument, you type the cell address of the upper-left corner of the range followed by two periods and the cell address of the bottom-right corner of the range. Range A1..B2, for example, comprises cells A1, A2, B1, and B2. You can also use a range name to specify a range argument.

The third type of function argument is a string. A string can consist of letters, numbers, and special characters. String arguments are used extensively with logical functions and string functions.

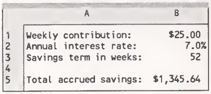
In functions that use the contents of a cell as an argument, you can substitute a cell address for a numeric value or a string argument. For example, to find the positive square root of a number in cell A1, enter the formula @SQRT(A1) in another cell.

The Financial Functions

The financial functions (see the @function table) facilitate loan, annuity, depreciation, and cash flow calculations. When you use financial functions, make sure that you express the interest rate and the term in the same units of time. For example, suppose you want to borrow $8,000 at an annual interest rate of 11% and pay it back over four years. To calculate monthly payments, express the arguments in months. You must divide the annual interest rate by 12 and multiply the term of 4 years by 12 months per year. The formula you need is @PMT(8000,11%/12,4*12).

The future-value function calculates the future value of an investment based on a series of equal payments that earn a periodic interest rate. It looks like this: @FV(*payment,interest,term*). Suppose you contribute $25 to your vacation account each week. The account earns 7% annually. To calculate how much you'll have saved after one year, enter the formula @FV(25,7%/52,52). Notice that because you are using a weekly payment, the rate and term arguments are expressed in weeks.

To see how different weekly contributions or varying investment durations affect your savings plan, set up a worksheet as shown below. The formula in cell B5 is @FV(B1,B2/52,B3). To see how your savings grow if you contribute $30 per week, enter 30 in cell B1, and the program will recalculate the result automatically. To see how much you can save in a year and a half, enter 78 in cell B3.



	A	B
1	Weekly contribution:	$25.00
2	Annual interest rate:	7.0%
3	Savings term in weeks:	52
4		
5	Total accrued savings:	$1,345.64

The Statistical Functions

The statistical functions perform calculations such as sums, averages, standard deviations, and variances. The statistical @function formula that you'll probably use most is @SUM(*list*). This formula adds the numbers in the argument *list*, which can be a range, a number, or a cell address. For example, to add the numbers in range A1..D5, you enter @SUM(A1..D5) in a cell.

@SUM can also take a series of ranges, values, and cell addresses as arguments. To add the numbers in range A1..D5, the range named *totals*, and the value 5, enter the formula @SUM(A1..D5,totals,5). Notice that there are no spaces between arguments and that they are separated by commas.

The rules that apply to the @SUM function also apply to the @MAX function. @MAX(*list*) returns the largest value in *list*. If you set up your worksheet so that you have a range of cells that contains a group of values, you can use @MAX to select the largest value in the range. For example, the formula @MAX (B1..L5) returns the largest value in that range.

1-2-3 and *Symphony* also provide a subset of statistical functions that operate on records stored in a database. These are called database statistical functions. By combining these functions with database selection criteria, you can create database reports. For example, suppose you have a large database of customer names and addresses. You want to find out how many customers are located in a particular state. Provided that you've entered the state portion of the address in a separate column, you can use the @DCOUNT function to extract the information you need.

The formula syntax looks like this: @DCOUNT(*input range,offset,criterion*). *Input range* is the entire database; *offset* specifies the database field, or column, that contains the state portion of each address; *criterion* is the range containing the selection criterion you set up—in this case the state. If your database is large, or if your selection criteria are complex, the database statistical functions are essential in getting the information you want from your database.

The String Functions

String functions are used with labels. Depending on the one you use, these functions return strings or numbers. For example, the formula @LENGTH(*string*) returns the number of characters in *string*. @LEFT(*string,n*) returns a string made up of the first *n* characters of *string*.

Suppose you enter in cell A1 the label *Summary Report*. If you enter the formula @LENGTH(A1) in another cell, the formula returns 14 because the label is 14 characters long. Note that @LENGTH counts blank spaces, as well as characters. If you enter @LEFT(A1,7) in a cell, the result is *Summary*, the first seven characters of the label in cell A1.

Another useful string-function formula is @VALUE(*string*). This formula lets you perform calculations on a number you've entered as a label. For example, suppose you enter 3 as a label in cell A1. To multiply the contents of cell A1 by 15%, you enter the formula @VALUE(A1)*15% in another cell.

You can use the @VALUE function to perform calculations on stock prices that you enter as labels. This technique is handy because *1-2-3* and *Symphony* perform decimal conversion for you. For example, if you enter the label *24 ½* in cell B1 and the label *29 ⅝* in cell B2, you can find the difference between the two prices with the formula @VALUE(B2)−@VALUE(B1). Be aware that you need to include a character space between the whole number and the fraction to get a valid result.

The Date and Time Functions

Your spreadsheet stores dates and times as serial numbers. These serial numbers are based on the number of days that have passed since January 1, 1900. The serial number for that date is 1. The serial number for January 2, 1900, is 2. The serial number for September 1, 1989, is 32752.

Serial numbers can also have a fractional component, which designates a time of day. The .5 in the serial number 32752.5 represents half a day, or the time

MICHAEL WITTE

12 noon on September 1, 1989.

Date and time functions generate and use serial numbers. For example, the @NOW function returns the serial number for the current date and time. @DATE(*year,month,day*) returns the serial number for a specific date. To enter the date September 15, 1989, you use the formula @DATE(89,9,15), which returns the serial number 32766. If you're using *1-2-3* Release 3, you can enter a date in one of the date formats and the program will automatically convert your entry to a date serial number.

If you want to display a date in a date format rather than as a serial number, you assign the Date format to the cell containing the date serial number. In *1-2-3* you press slash, select Range Format Date, and indicate a format. In *Symphony* you select MENU Format Date and indicate a format.

Since dates and times are represented by serial numbers, you can perform calculations with them. For example, to determine the number of days between two dates, you subtract the earlier date from the later date. Even if you enter a date as a label, such as '1/1/90, you can perform calculations on the date by using the @DATEVALUE function.

@DATEVALUE(*date-string*), for example, returns the integer, or whole number, part of the serial number represented by *date-string*. Suppose you entered the label '*1/1/90* in cell A1 and the label '*4/27/91* in cell A2. To calculate the number of days between the dates, enter @DATEVALUE(A2) – @DATEVALUE(A1) in another cell.

The Special Functions

Special functions perform a variety of advanced tasks, most notably vertical and horizontal table lookups. The vertical lookup function takes the form @VLOOKUP(*item,range,column offset*). It is used in formulas to retrieve values stored in tables.

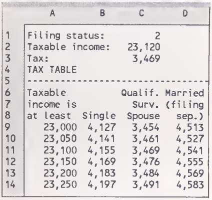
The *item* argument is the value or label you want to look up. *Range* is the range of the table in which the value or label is located. *Column offset* is the column in which the result is located.

THE LOTUS @FUNCTIONS

		1-2-3 Releases			*Symphony* Releases	
Function	**Returns**	**1A**	**2, 2.01, 2.2**	**3**	**1, 1.01**	**1.1, 1.2, 2.0**
The Financial Functions						
@CTERM	Investment term to maturity		x	x		x
@DDB	Double-declining-balance depreciation		x	x		x
@FV	Future value of equal payments	x	x	x	x	x
@IRR	Internal rate of return	x	x	x	x	x
@NPV	Present value of future cash flows	x	x	x	x	x
@PMT	Periodic payment amount	x	x	x	x	x
@PV	Present value of equal payments	x	x	x	x	x
@RATE	Periodic interest rate		x	x		x
@SLN	Straight-line depreciation		x	x		x
@SYD	Sum-of-the-years'-digits depreciation		x	x		x
@TERM	Investment payment periods		x	x		x
@VDB	Variable declining-balance depreciation			x		
The Statistical Functions						
@AVG	Average of values	x	x	x	x	x
@COUNT	Number of nonblank entries	x	x	x	x	x
@MAX	Maximum value	x	x	x	x	x
@MIN	Minimum value	x	x	x	x	x
@STD	Population standard deviation	x	x	x	x	x
@STDS	Sample standard deviation			x		
@SUM	Sum of values	x	x	x	x	x
@SUMPRODUCT	Sum of products of multiple ranges			x		
@VAR	Population variance of values	x	x	x	x	x
@VARS	Sample variance of values			x		
@DAVG	Database average	x	x	x	x	x
@DCOUNT	Database item count	x	x	x	x	x
@DGET	Database field entry			x		
@DMAX	Largest database value	x	x	x	x	x
@DMIN	Smallest database value	x	x	x	x	x
@DQUERY	External database command			x		
@DSTD	Database population standard deviation	x	x	x	x	x
@DSTDS	Database sample standard deviation			x		
@DSUM	Sum of database values	x	x	x	x	x
@DVAR	Variance of database values	x	x	x	x	x
@DVARS	Sample variance of database values			x		
The String Functions						
@CHAR	LICS character of code number		x	x	x	x
@CLEAN	String free of control characters		x	x	x	x
@CODE	LICS code number of first character		x	x	x	x
@EXACT	1 if strings match exactly, otherwise 0		x	x	x	x
@FIND	Location of characters		x	x	x	x
@LEFT	First *n* characters in string		x	x	x	x
@LENGTH	Number of characters in string		x	x	x	x
@LOWER	All letters in string in lowercase		x	x	x	x
@MID	*N* characters from string		x	x	x	x
@N	Numeric value of upper-left cell in range		x	x	x	x
@PROPER	Capitalization of each word in string		x	x	x	x
@REPEAT	Label consisting of repeated characters		x	x	x	x
@REPLACE	Replacement string		x	x	x	x
@RIGHT	Last *n* characters in string		x	x	x	x
@S	String value of upper-left cell in range		x	x	x	x
@STRING	Label equivalent of value		x	x	x	x
@TRIM	Removes leading/trailing spaces		x	x	x	x
@UPPER	All string characters in uppercase		x	x	x	x
@VALUE	Number that represents value of label that looks like a number		x	x	x	x

Function	Returns	*1-2-3* Releases 1A	*1-2-3* Releases 2, 2.01, 2.2	*1-2-3* Releases 3	*Symphony* Releases 1, 1.01	*Symphony* Releases 1.1, 1.2, 2.0
The Date and Time Functions						
@DATE	Serial date number	x	x	x	x	x
@DATEVALUE	Integer portion of date number from a date label		x	x	x	x
@DAY	Day number between 1 and 31	x	x	x	x	x
@D360	Number of days between two dates			x		
@HOUR	Time integer value		x	x	x	x
@MINUTE	Minute integer value		x	x	x	x
@MONTH	Month integer value	x	x	x	x	x
@NOW	Current date and time		x	x	x	x
@SECOND	Second integer value		x	x	x	x
@TIME	Time passed since 12:00 A M.		x	x	x	x
@TIMEVALUE	Decimal value of time label		x	x	x	x
@TODAY	Serial number of current date	x	x	x		
@YEAR	Year integer number	x	x	x	x	x
The Special Functions						
@@	Contents of referenced cell		x	x	x	x
@CELL	Cell attribute information		x	x	x	x
@CELLPOINTER	Information about current cell		x	x	x	x
@CHOOSE	Item selected from a list	x	x	x	x	x
@COLS	Number of columns in a range		x	x	x	x
@COORD	Cell address		x			
@ERR	Value ERR	x	x	x	x	x
@HLOOKUP	Item within a table	x	x	x	x	x
@INDEX	Item within a range		x	x	x	x
@INFO	System information			x		
@NA	Value NA	x	x	x	x	x
@ROWS	Number of rows in a range		x	x	x	x
@SHEETS	Number of worksheets in a range			x		
@VLOOKUP	Item within a table	x	x	x	x	x
The Logical Functions						
@FALSE	Logical value 0	x	x	x	x	x
@IF	Conditional result of 1 or 0	x	x	x	x	x
@ISAPP	1 if named add-in is attached, otherwise 0		x	x		
@ISERR	1 if value is ERR, otherwise 0	x	x	x	x	x
@ISNA	1 if value is NA, otherwise 0	x	x	x	x	x
@ISNUMBER	1 if numeric value, otherwise 0		x	x	x	x
@ISRANGE	1 if defined range name, otherwise 0			x		
@ISSTRING	1 if string value, otherwise 0		x	x	x	x
@TRUE	Logical value 1	x	x	x	x	x
The Mathematical Functions						
@ABS	Absolute (positive) value	x	x	x	x	x
@ACOS	Arc cosine of angle	x	x	x	x	x
@ASIN	Arc sine of angle	x	x	x	x	x
@ATAN	2-quadrant arc tangent	x	x	x	x	x
@ATAN2	4-quadrant arc tangent	x	x	x	x	x
@COS	Cosine of angle	x	x	x	x	x
@EXP	The number *e* to the *x*th power	x	x	x	x	x
@INT	Integer portion of number	x	x	x	x	x
@LN	Natural log (base *e*) of value	x	x	x	x	x
@LOG	Common log (base 10) of value	x	x	x	x	x
@MOD	Remainder of a division operation	x	x	x	x	x
@PI	Numeric value of *pi*	x	x	x	x	x
@RAND	Quasi-random number between 0 and 1	x	x	x	x	x
@ROUND	Number rounded to *n* places	x	x	x	x	x
@SIN	Sine of angle	x	x	x	x	x
@SQRT	Positive square root of value	x	x	x	x	x
@TAN	Tangent of angle	x	x	x	x	x

Here's an example. You're setting up an income tax worksheet that includes the hypothetical tax table shown below. You want the program to use the table to look up the tax, based on the filing status in cell C1 and the income figure in cell C2. When it finds the tax, the program should display that amount in cell C3. All you need to do is enter the formula @VLOOKUP(C2,A9..D14,C1) in cell C3.



```
         A          B        C        D

1   Filing status:           2
2   Taxable income:     23,120
3   Tax:                 3,469
4   TAX TABLE
5   ------------------------------
6   Taxable           Qualif. Married
7   income is           Surv. (filing
8   at least  Single  Spouse    sep.)
9     23,000   4,127   3,454    4,513
10    23,050   4,141   3,461    4,527
11    23,100   4,155   3,469    4,541
12    23,150   4,169   3,476    4,555
13    23,200   4,183   3,484    4,569
14    23,250   4,197   3,491    4,583
```

The program compares the income figure in cell C2 with each cell in column A, the first column of the table. When it locates the cell that contains a value equal to the income figure or the highest number that is less than the income figure, it moves across that row the number of columns specified by the *offset* argument, which in this example is the filing status. Since the number in the cell representing the filing status is 2, and the left-most column of the table is numbered 0, it moves two columns to the right and returns 3,469, the value found in cell C11. This tax amount is displayed in cell C3.

The @CHOOSE function is another handy special function. You can use it to return a value selected from a list of possible results. It is written as @CHOOSE (*selector,result 0,result 1,...,result n*). The *selector* argument chooses a value from the list: *result 0,result 1,...result n*. The list can include numbers or strings.

The first value or string in the list is in position 0; therefore, if *selector* is 1, @CHOOSE returns the second value or string in the list. If you enter the formula @CHOOSE(1,"Yes","No") in a cell, the result displayed in the cell is *No*, since "No" is in position 1 in the list.

@CHOOSE is often used to display the day of the week for a particular date. Suppose you enter a series of dates beginning in cell A1 with the @DATE function. To display the day of the week for each date, you enter the following @CHOOSE formula in cell B1 and copy it down column B:

> @CHOOSE(@MOD(A1,7),"Sat",
> "Sun","Mon","Tue","Wed",
> "Thu","Fri")

Notice that this @CHOOSE formula uses the mathematical function @MOD. @MOD divides the date serial number in cell A1 by 7 and returns the remainder. The remainder (a number between 0 and 6) corresponds to the day of the week. This number is used by the @CHOOSE function to return a string that represents the name of a day.

The Logical Functions

The logical functions produce values or strings based on the result of a conditional statement. The conditional statement is either true or false. For example, if cell A1 contains the value 5, then the conditional statement +A1=5 is true. Likewise, the statement +A1=8 is false.

The formula @IF(*condition,true result,false result*) lets you specify a result based on whether the conditional statement is true or false. For instance, suppose you want to display *Profit* in cell A20 if the value in cell B20 is greater than or equal to 100,000. And you want to display *Loss* in cell A20 if the value in cell B20 is less than 100,000. Enter the formula @IF(B20>=100000,"Profit","Loss") in cell A20. If the condition B20>=100000 is true, then cell A20 displays the second argument, *Profit*. If the condition is false, it displays the third argument, *Loss*.

By embedding an @IF formula within another @IF formula, you can increase the possible results to three or more. For example, suppose you want to display *Profit* if the value in cell B20 is greater than 100,000, *Loss* if it's less than 100,000, and *Breakeven* if it's equal to 100,000. The following formula, in which the third argument is another @IF formula, does the trick:

> @IF(B20>100000,"Profit",@IF(B20<
> 100000,"Loss","Breakeven"))

The Mathematical Functions

You can use 17 mathematical functions to perform simple to complex calculations. You can isolate the integer part of a number with @INT or compute a natural logarithm of a number with @LN. Even if you don't perform sophisticated mathematics, you're likely to use mathematical functions such as @ROUND, which takes the form @ROUND(*value,places*). It returns a number that results from rounding *value* to the number of decimal places specified by *places*.

You can embed an @ROUND formula within an @IF formula to test whether two numbers are approximately equal. For example, suppose you want to test whether the result of a formula in cell C5 equals 5, give or take 0.05. You could use the formula @IF(@ROUND(C5,1)=5,"okay","check"). If the result in cell C5 is greater than or equal to 4.95 and less than 5.05, the formula displays *okay*. If not, it displays *check*. The @ROUND formula rounds the value in cell C5 to the nearest tenth. If you enter 4.95, the value in cell C5 is rounded up to 5.0. If you enter 5.05, it is rounded up to 5.1.

A function you'll want to use if you're calculating measurements of circles is @PI. It returns the numeric value of pi rounded to 10 decimal places. For example, to find the circumference of a circle with a diameter of 6 feet, you would enter into a cell the formula @PI*6.

Take a few minutes to peruse the @function table on page 78. It provides a comprehensive list of functions available in all Lotus spreadsheet programs. You're bound to find a function you've overlooked until now. For example, did you know that the @CHAR function lets you put borders around a range, or that the @RAND function generates a random number between 0 and 1? There are even functions to count the number of rows or columns in a range—@ROWS and @COLS. ■

Paula Dempsey, a frequent contributor to LOTUS, *most recently described how to create instant business letters in* 1-2-3.

@FUNCTION ADD-INS YOU CAN BUY

@Library—Science & Engineering Applications, @Library—Statistical Applications, @Library—General Applications. IRG Information Systems, 100 North Country Rd., Setauket, NY 11733; 516-689-7682. Works with *1-2-3* Releases 2/2.01/2.2 and with all releases of *Symphony*. $79.95 each.

@functions #1. Intex Solutions, 161 Highland Ave., Needham, MA 02194; 617-449-6222. Provides 45 @functions. Works with *1-2-3* Release 2/2.01 and with all releases of *Symphony*. $35.

@stats. Intex Solutions, 161 Highland Ave., Needham, MA 02194; 617-449-6222. Provides 44 statistical and mathematical @functions. Works with *1-2-3* Release 2/2.01 and with all releases of *Symphony*. $295.

Option Price Calculations. Intex Solutions, 161 Highland Ave., Needham, MA 02194; 617-449-6222. Provides 13 @functions to evaluate a portfolio of options. Works with *1-2-3* Release 2/2.01. $395.

Mortgage-Backed Calculations. Intex Solutions, 161 Highland Ave., Needham, MA 02194; 617-449-6222. Provides 33 @functions to calculate yields, price, duration, total return, and other calculations for mortgage-backed securities. Works with *1-2-3* Release 2/2.01. Basic Version $395; Advanced Version $695.

@Fixed_Income. Spreadsheet Solutions, 600 Old Country Rd., Garden City, NY 11530; 800-634-8509. A library of 44 financial @functions. Works with *1-2-3* Release 2/2.01 and with all releases of *Symphony*. $795.

@Ease. Spreadsheet Solutions, 600 Old Country Rd., Garden City, NY 11530; 800-634-8509. Provides 12 @functions to sum numbers, center titles, generate dates, check or summarize a range, and produce subtotals and grand totals. Works with *1-2-3* Release 2/2.01 and with all releases of *Symphony*. $99.95.

@Risk. Palisade Corp., 2198 Elmira Rd., Newfield, NY 14867; 800-432-7475. Provides 30 @functions that perform risk analysis, probability distribution, and Monte Carlo simulation. Works with *1-2-3* Release 2/2.01. $395.

CHOOSE FORMULAS OVER MACROS

Formulas and @functions can analyze data faster than most macro routines can.

BY NICK DELONAS

The most potent workhorse in *1-2-3* is the @function. So don't make the mistake of macro overreliance. If you use macros to analyze a database, try replacing them with some advanced @D functions. They'll make your spreadsheets simpler, easier to use, and more efficient. Some of our macro examples work only in post-1A releases of *1-2-3*. All of the formulaic solutions work in *Symphony* as well as *1-2-3*.

Doing It the Hard Way

Imagine that you're working with data on sales representatives, structured as shown below in figure 1.

A coworker asks for a printout of the database, with each employee's total sales increased by 21%. The report will be used to assign next year's sales goals.

You make a temporary copy of the database file, assign the name *input* to range A1..D20, and then write the macro shown in figure 2.

To create this macro, enter the labels as shown. Begin the entry in cell O17 with an apostrophe. Assign the labels in column O as range names for the labels in column P: Press slash, select Range Name Labels Right, and indicate range O17..O18. Create the database by entering labels and values as shown in the first figure. Select /Range Format Currency, enter 0, and indicate range D2..D20.

To start the macro, hold down the MACRO key (Alt on most computers) and press U.

This macro increases all the sales figures by 21%. It first moves the cell pointer to the top-left corner of the database (range-named *input*) and then to the top of the *Sales* column (column D). The macro multiplies the value in the current cell by 1.21, enters the result, and moves down to the next cell. The macro then loops. Wait until it has finished with the column, then hold down the Control key and press the Break key to stop the macro. Next, press the Escape key to clear the resulting error and return to Ready mode. Erase any extraneous labels containing *1.21 that the macro enters below the database.

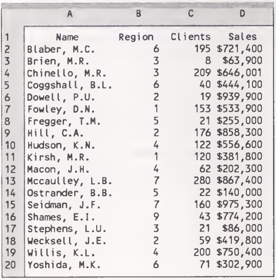
This seems like a reasonable approach, but suppose this database fills 5,000 rows. Even on a fast computer, you could wait as long as 10 minutes before the macro reaches the last sales figure in the column. Add to that the time it took you to write the macro, and suddenly it doesn't seem so convenient.

A better solution is to enter +D2*1.21 in cell E2 and copy that formula to range E3..E20. Select /Range Value, and indicate range E2..E20 as the From range and cell D2 as the To range. Then erase the formulas in column E and format range D2..D20 for currency.

Routine Analysis

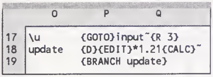
Imagine that you update this sales database daily and analyze the data every other week. To help with analysis, you decide that you need to know the sales for each region (1 through 9), and you write the macro shown in figure 3.

To create the macro, enter the labels as shown. Use the Range Name Labels Right command to assign the labels in range



	A	B	C	D
1	Name	Region	Clients	Sales
2	Blaber, M.C.	6	195	$721,400
3	Brien, M.R.	3	8	$63,900
4	Chinello, M.R.	3	209	$646,001
5	Coggshall, B.L.	6	40	$444,100
6	Dowell, P.U.	2	19	$939,900
7	Fowley, D.N.	1	153	$533,900
8	Fregger, T.M.	5	21	$255,000
9	Hill, C.A.	2	176	$858,300
10	Hudson, K.N.	4	122	$556,600
11	Kirsh, M.R.	1	120	$381,800
12	Macon, J.H.	4	62	$202,300
13	Mccaulley, L.B.	7	280	$867,400
14	Ostrander, B.B.	5	22	$140,000
15	Seidman, J.F.	7	160	$975,300
16	Shames, E.I.	9	43	$774,200
17	Stephens, L.U.	3	21	$86,000
18	Wecksell, J.E.	2	59	$419,800
19	Willis, K.L.	4	200	$750,400
20	Yoshida, M.K.	6	71	$302,900

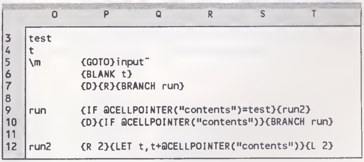
FIGURE 1



```
          O           P           Q

17   \u          {GOTO}input~{R 3}
18   update      {D}{EDIT}*1.21{CALC}~
19               {BRANCH update}
```

FIGURE 2



```
          O           P           Q           R           S           T

3    test
4    t
5    \m          {GOTO}input~
6                {BLANK t}
7                {D}{R}{BRANCH run}
8
9    run         {IF @CELLPOINTER("contents")=test}{run2}
10               {D}{IF @CELLPOINTER("contents")}{BRANCH run}
11
12   run2        {R 2}{LET t,t+@CELLPOINTER("contents")}{L 2}
```

FIGURE 3

O3..O12 as range names for column P.

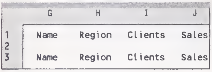
To find the total sales for a particular region, you enter the region number in *test* (cell P3) and run the macro by pressing MACRO-M. The macro analyzes the data and enters the total sales amount for the particular region in *t* (cell P4).

Here's a summary of how *\m* works:

First, the macro moves the cell pointer to the top-left corner of the database (range-named *input*). Then it moves the pointer down column B and compares each number with the number you entered in *test*. When the macro finds the correct region number, it moves the pointer two cells to the right, adds the value there to the value in *t*, moves the pointer back to the left, and continues down the column. When the cell pointer comes to a blank cell, the macro stops.

Again, this macro works almost instantaneously on a small database. On a database with thousands of rows, however, this routine takes several minutes to come up with an answer.

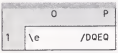
For speed, you use *1-2-3*'s Data Query commands. First you set up Criterion and Output ranges as shown below:



	G	H	I	J
1	Name	Region	Clients	Sales
2				
3	Name	Region	Clients	Sales

To do this, copy range A1..D1 to cell G1, and then copy it to cell G3. To prepare for a query, select /Data Query and assign the range named *input* as the Input range. Assign range G1..J2 as the Criterion range and range G3..J3 as the Output range. Then select Quit. Enter the desired region number in cell H2, and issue the Data Query Extract command to extract all the records of that region. You can then create an @SUM formula to determine the total sales for the region of choice. Select Quit from the menu, then change the value in cell H2, and press the QUERY key to extract records of another region.

This manual technique is convenient unless you routinely use the other Data Query commands, in which case you can create the following short macro that will work under any circumstances.



	O	P
1	\e	/DQEQ

Begin each of the entries with an apostrophe, and assign the label in cell O1 as a range name for cell P1.

This macro uses the Data Query Extract command to extract the records matching the criterion.

The Best Approach

Though reasonable, even the above technique is clumsy and slow compared with the @DSUM formula.

@DSUM has the syntax @DSUM(*input,offset,criterion*). The first argument is the input range of the database. The second argument is the offset of the column you want summed. The third argument is the Criterion range. In our example, the database corresponds to the range named *input*. The offset is 3, since the D column (under *Sales*) is three columns to the right of the first column in *input*. The Criterion range is G1..J2. So, @DSUM(input,3,G1..J2) determines sales for all records that match the criterion.

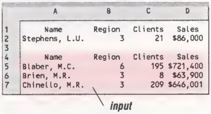
All releases of *1-2-3* and *Symphony* offer at least seven @D formulas for database analysis. For instance, you can use the same Criterion range and input arguments to determine the average sales per person in a particular region using @DAVG. You can determine the number of sales records that match the criterion using @DCOUNT. You can find the maximum or minimum sales amount using @DMAX or @DMIN. You can calculate the population standard deviation in a region with @DSTD and the population variance with @DVAR.

Simple Lookups

If you want to look up a particular individual and get his or her region, number of clients, and total sales, you have several options.

Clearly, a macro that moves the cell pointer through the entire database searching for a particular name is not the best choice. Using the Data Query Find or the Data Query Extract command is certainly sensible. These commands are flexible and fast. But if you're planning to spend lots of time looking up records, another option—the @VLOOKUP formula—is better.

You can rearrange the worksheet as shown in the following figure:



	A	B	C	D
1	Name	Region	Clients	Sales
2	Stephens, L.U.	3	21	$86,000
3				
4	Name	Region	Clients	Sales
5	Blaber, M.C.	6	195	$721,400
6	Brien, M.R.	3	8	$63,900
7	Chinello, M.R.	3	209	$646,001

Use the Worksheet Insert Row command to insert three rows above row 1. Copy range A4..D4 to cell A1. Cells in range B2..D2 contain @VLOOKUP formulas that return values or labels based on the label in cell A2. You simply enter any name in cell A2, and the formulas display the associated region, number of clients, and sales amount.

The @VLOOKUP formula has the syntax @VLOOKUP(*x,range,column number*). The formula searches down the first column of the range identified in the second argument of the formula. When it finds a value or label that matches the first argument, *x*, it returns the contents of the cell intersecting that row and the column specified by the column number in the last argument.

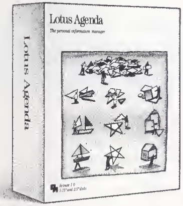
In the example, cell B2 contains the formula @VLOOKUP(A2,input,1), cell C2 contains the formula @VLOOKUP(A2,input,2), and cell D2 contains the formula @VLOOKUP(A2,input,3).

This formula approach has the advantage of requiring fewer keystrokes than using the Data Query process to get the information you need. It's fast and easy.

Whatever the task, your first inclination should be to set up the solution as a spreadsheet and not as a custom software program. First see if there is a formula-based solution to a problem. If not, investigate menu and function key solutions such as the Data Query commands and the QUERY key. Under most circumstances, creating a macro should be your last resort. ■

Nick Delonas is the assistant macros editor.

Put information in its place.



Mom used to say there was a place for everything and everything belonged in its place. The idea was that if you kept things organized, you'd always be able to find them when needed. Today, that idea still holds true, and it's the basis for a terrific new software product called Lotus® Agenda®.

Agenda acts as your personal information manager, helping you keep track of names, dates, "to-do" items and much more. Agenda's flexible design lets you enter this information into your PC without having to structure it in advance.

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CIRCLE 116 ON READER SERVICE CARD

WRITE YOUR FORMULAS IN BOOLEAN SHORTHAND

If you can count to one, you can use these math techniques to shrink your formulas.

BY RICHARD CRANFORD

Even if you're unabashedly math phobic, you can master the simple Boolean math techniques described here. The payoff is worth it: You'll be able to write shorter, more powerful formulas. These formulas will use less memory than conventional formulas, and they'll evaluate more quickly. If you build worksheets that contain hundreds of formulas, the time and memory savings you'll realize will be appreciable. And you can use these techniques with all versions of *1-2-3* and *Symphony*.

The Boolean Basics

You use Boolean math every time you write an @IF formula. In this article, you'll learn to apply Boolean techniques to @IF formulas and to other types of formulas as well. In Boolean math, the only possible results of any expression are 0 and 1. Furthermore, the only arguments used in a Boolean expression are 0 and 1. Finally, Boolean math uses two operators you may not be familiar with: AND and OR.

Consider the logical formula @IF (B6<500,0.05,0.1). It returns the value 0.05 if the current value of cell B6 is less than 500. It returns .1 if cell B6 is greater than or equal to 500.

Your spreadsheet uses the following logic when it processes this formula: If the value of the first argument (B6<500) is equal to 1, the formula returns the value of the second argument (0.05); otherwise, it returns the value of the third argument (0.1).

The value of the first argument is 1 when the expression that comprises it is true—the value in cell B6 is less than 500. If the value in cell B6 is greater than or equal to 500, the expression is not true. In this case, the expression B6<500 returns 0.

To demonstrate this, load *1-2-3* or *Symphony* and enter 300 in cell B6 of an empty worksheet. In cell D6 enter the formula +B6<500. The formula returns 1 because the value in cell B6 is less than 500. Change the number in cell B6 to 500, and the formula in cell D6 returns 0. Any cell formula or expression within a cell formula that contains the mathematical operators =, <, >, <=, >=, or <> is a Boolean expression and can therefore return only 0 or 1.

Because of the way *1-2-3* and *Symphony* are designed, the first argument of an @IF formula is automatically a Boolean expression. This is true regardless of whether you include mathematical operators in the argument. For example, with the value 500 still in cell B6, enter in cell D8 the formula @IF(B6,30,90). At first glance, this seems to be an incomplete @IF statement. The first argument does not contain a mathematical operator. Yet the formula works and returns the value 30 rather than ERR.

The reason is that *1-2-3* and *Symphony* interpret the first argument as "if cell B6 is not equal to zero." When this condition is met, the formula returns 30. If cell B6 were equal to zero, the formula would return the third argument, 90.

Applying Boolean Techniques

You can exploit this feature of your spreadsheet to write shorter formulas and save memory. Simply leave the expression <>0 out of the first argument of @IF formulas. @IF(B6,30,90) is equivalent to @IF(B6<>0,30,90). Be aware, though, that this shortened version of an @IF formula is not equivalent to the formula @IF(B6>0,30,90). The first formula returns the middle argument, 30, when cell B6 contains a negative value. The second formula returns the last argument, 90, when cell B6 contains a negative value.

If you want an expression to evaluate to one of two nonzero values, you must use @IF. But if the possible results of an expression are to be some nonzero value or zero, you can do it without @IF. Since Boolean expressions return only 0 or 1, you can multiply a value by a Boolean expression to make the value evaluate to 0 under certain conditions.

For example, in the worksheet in figure 1, a 5% discount is applied to the total cost of an item when the quantity ordered is 50 or more.

One possible way that you can write the formula in cell E3 is:

`@IF(C3>=50,D3*0.05,0)`

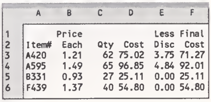
Here's the Boolean equivalent of that formula:

`+D3*0.05*(C3>=50)`

As you can see, it is shorter and more efficient.

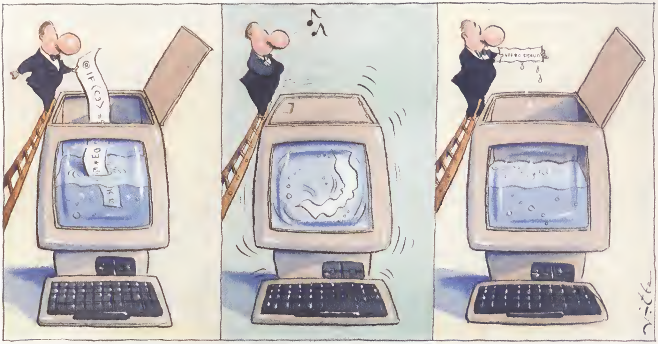
Since the value in cell C3 is greater than or equal to 50, the second formula multiplies the product of 75.02 times 0.05 by 1, giving 3.75 times 1, or 3.75. If you copy this formula into range E4..E6 and look at the resulting formula in cell E5, you see that the formula multiplies the product of 25.11 times 0.05 by 0. This is because cell C5 is not greater than or equal to 50. The result is 1.26 times 0, or 0.

The second formula is not much shorter than the first. But if you apply this technique to a long formula or if you make several hundred copies of such a formula, the amount of memory you save is significant.



	A	B	C	D	E	F
1		Price			Less	Final
2	Item#	Each	Qty	Cost	Disc	Cost
3	A420	1.21	62	75.02	3.75	71.27
4	A595	1.49	65	96.85	4.84	92.01
5	B331	0.93	27	25.11	0.00	25.11
6	F439	1.37	40	54.80	0.00	54.80

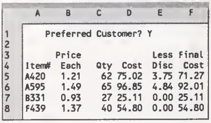
FIGURE 1



Working with Logical Operators

Boolean math also lets you determine whether two or more values at a time are zero or nonzero. You do this by combining Boolean techniques with the logical operators AND and OR. In *1-2-3* and *Symphony* these operators are spelled with number signs: #AND# and #OR#. The number signs are part of the operator, so when you read a cell formula and you see #AND#, just say "and," the way you'd say "plus" when you see the plus sign.

The most common use of #AND# and #OR# is in the first argument of @IF formulas. You use #AND# if you want the first argument to return 1 if all of its expressions are true. You use #OR# if you want the first argument to return 1 if any of its expressions are true. For example, suppose you want to modify the worksheet we looked at earlier so that the 5% discount is given if the quantity ordered is 50 or more and if the customer has preferred status. The worksheet would look like figure 2.



```
     A       B       C     D      E     F
1        Preferred Customer? Y
2
3          Price                  Less Final
4   Item#  Each     Qty  Cost   Disc  Cost
5   A420    1.21     62 75.02   3.75 71.27
6   A595    1.49     65 96.85   4.84 92.01
7   B331    0.93     27 25.11   0.00 25.11
8   F439    1.37     40 54.80   0.00 54.80
```

FIGURE 2

The formula in cell E5 now reads:

@IF(C5>=50#AND#E$1="Y",
D5*0.05,0)

If this formula is copied to range E6..E8, the results are the same as in the earlier worksheet. The discount applies only to the first two items. The difference here is that a customer must have preferred status to get the discount when ordering 50 or more items. Since both conditions must be true for there to be a connected the expressions C5>=50 and E$1="Y" by using the operator #AND#. If the label in cell E1 is changed to *N*, there is no case where both conditions are true, so all the formulas in range E5..E8 return 0.

Now consider a scenario where any customer gets a discount when ordering 50 or more of an item, and a preferred customer always gets a discount. That is, the discount applies if the customer is preferred or if the quantity ordered is 50 or more. To reflect this, the formula in cell E5 is changed to:

@IF(C5>=50#OR#E$1="Y",
D5*0.05,0)

If the label in cell E1 is *N*, the discount formulas in column E again return 3.75, 4.84, 0.00, and 0.00. In the first two cases, at least one of the expressions in the @IF function's first argument is true—that is, the quantity ordered is 50 or more. In the last two cases, neither expression is true, so the formula returns 0.

If the label in cell E1 is changed to *Y*, all of the discount formulas return an amount other than 0 because in all cases at least one of the expressions is true. Both are true in the first two cases, and the second expression, E$1="Y", is true in the last two cases.

Just as you can omit the mathematical operators when using @IF to evaluate an expression, you can also omit them in expressions connected by #AND# and #OR#. The formula @IF(B6#AND#B9, 30,90) returns 30 if cells B6 and B9 both contain or return values other than 0. If either of them evaluates to 0, the formula returns 90. On the other hand, @IF(B6 #OR#B9,30,90) returns 30 if either cell B6 or cell B9 evaluates to a number that is not zero. The formula returns 90 only if cells B6 and B9 both evaluate to 0.

You can also connect expressions with

MICHAEL WITTE

#AND# and #OR# without using the @IF function. For example, substitute in cell E5 the following:

+D5*0.05*(C5>=50#AND#E$1="Y")

The expression (C5>=50#AND#E$1="Y") returns either 0 or 1. As a result, this formula multiplies the product of cell D5 times 0.05 by either 0 or 1.

Points to Remember

The amount of memory you save by using these techniques in a few formulas is negligible. Unless you plan to make a hundred or more copies of a formula, you may be better off leaving in the characters <>0 or using the @IF function rather than a stand-alone Boolean expression.

Here's why: Someday, someone may need to analyze or modify a worksheet that you've created. The formulas @IF(B6,30,90) and @IF(B6<>0,30,90) both return 30 if the value in cell B6 is not equal to 0. But the second formula shows exactly what's being evaluated and is therefore more informative.

Similarly, +D3*0.05*(C3>=50) multiplies the product of cell D3 and .05 by either 1 or 0. The formula multiplies by 1 if cell C3 is greater than or equal to 50, and it multiplies by 0 if cell C3 is less than 50. But @IF(C3>=50,D3*0.05,0) expresses the operations in an order with which most users of *1-2-3* and *Symphony* are familiar. The sentence "If cell C3 is greater than or equal to 50, then return cell D3 times 0.05, otherwise return 0" seems more natural to most people than "cell D3 times 0.05 times cell C3 is greater than or equal to 50."

But computers and computer programs don't consider semantics when evaluating a mathematical operation. So if you need to coax a few more iotas of performance out of your large worksheets, consider using these Boolean techniques. They're a natural for the machines, if not for the people who use them. ■

Richard Cranford is associate editor for applications for LOTUS.

FIX THAT FORMULA

These debugging tips take the mystery out of flawed formulas.

BY E. MICHAEL LUNSFORD

Imagine that you've just typed a long, complex formula into a cell and pressed Return. You expect to see a calculated result appear, but instead you see ERR. Or maybe the computer beeps, and *1-2-3* or *Symphony* pops into Edit mode. For some reason, the formula is unacceptable. So what do you do now?

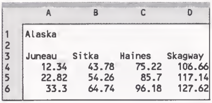
Tracking down the cause of an uninformative blinking cursor or an error message is often difficult. This article describes the symptoms of the most common formula flaws, offers solutions, and then summarizes the information in the table on page 88. In addition, the article teaches you how and when to use three approaches to debugging complex formulas. If you use *1-2-3* Release 3, you should read the box on page 89 before proceeding with the article.

To test most of the fixes presented here on some bug-ridden formulas, build the small worksheet shown in the figure on the next page. Enter the labels in rows 1 and 3. Then press slash and select Data Fill (in *Symphony*, press MENU and select Range Fill) and specify range A4..D6. Specify a start value of 12.34 and a step value of 10.48, then press Return twice.

Blinking Cursor at Beginning of Range Address

A blinking cursor at the beginning of a range address signifies one of two problems: a mistyped cell coordinate or a misspelled or nonexistent range name. Type the formula @SUM(AB7..ABC) into any blank cell in the worksheet and press Return. Because

MICHAEL WITTE



	A	B	C	D
1	Alaska			
2				
3	Juneau	Sitka	Haines	Skagway
4	12.34	43.78	75.22	106.66
5	22.82	54.26	85.7	117.14
6	33.3	64.74	96.18	127.62

you erroneously specified the second cell coordinate as ABC, the cursor blinks at the beginning of the first cell coordinate. Press the Escape key to clear the formula from the control panel. Type the formula @AVG(units) into another cell and press Return. Because you haven't already assigned the name *units* to a range, the cursor blinks under the first letter of *units*. Press Escape. To find out whether or not you've assigned a certain range name, select /Range Name Create (in *Symphony*, MENU Range Name Create). A list of named ranges appears in the control panel.

Fixing these types of problems is easy. You just enter the correct cell coordinates in the @SUM formula. If you discover that you haven't assigned the name *units* to the appropriate range, select /Range Name Create (in *Symphony*, MENU Range Name Create), enter the name *units*, and then specify the range. If you know that you already assigned the range name, make sure you spelled it correctly in the formula.

Blinking Cursor at Beginning of @Function Name

An error that's easy to spot and correct occurs when you misspell the name of an @function. Type the formula 100 + SUM(A4..A6) and press Return. The cursor blinks under the letter S in SUM. In this case, you failed to enter the @ sign. Similarly, if you try to enter the formula @SU M(A4..A6), the cursor blinks under the @ sign. The problem is the extra space in the @function's name. The cursor also blinks at the beginning of a misspelled @function name.

If you mistakenly type a close parenthesis instead of an open one after typing an @function name, *1-2-3* and *Symphony* interpret this as a misspelling of the @function. For example, if you type the formula @SUM)A4..A6) and press Return, the cursor blinks under the @ sign.

Blinking Cursor at an Empty Space

Another mistake that's easy to track down is the accidental inclusion of a space among the arguments of an @function. For example, type the formula @DATE(89, 12,7) in any blank cell and press Return. The cursor blinks at the space just before the number 12. Delete the space, press Return, and the formula works.

Blinking Cursor at the End of a Formula

Some of the most difficult errors to identify are the ones that cause the cursor to blink at the end of a formula. Your experience with such problems might have convinced you that a cursor blinking at the end of a formula signifies nothing. In fact, too many or too few parentheses often cause this problem.

When the cursor blinks at the end of a formula, count the open parentheses and compare that number to the number of close parentheses. If the numbers are not equal, you have either an extra or a missing parenthesis. Your job then is to pair up the parentheses until you locate the extra one or the one that's missing. The techniques described in the section "Three Ways to Debug a Formula" on page 89 will help you with that task.

A formula that's missing a comma or an argument also causes the cursor to blink at the end of the formula. Cell A1 in the figure contains the label *Alaska*. Suppose you want to use an @FIND formula that returns a number indicating the position of the *k* in that word. The formula's syntax is @FIND(*substring,source string, start number*), where *substring* is the string whose position you wish to know, *source string* is the string in which to search, and *start number* is the character location at which to begin the search. You can enter the correct formula @FIND("k",A1,0) in cell F1. It returns the value 4, indicating that the *k* is four characters from the leftmost character in the string *Alaska*.

But the cursor will blink at the end of the formula @FIND("k"A1,0) and the formula @FIND("k",A1). In the first case, a comma is missing just before the source argument. The second formula lacks a start-number argument. When the cursor blinks at the end of a formula that has an equal number of open and close parentheses, evaluate each @function's arguments, since that's where the problem lies.

The cursor also blinks at the end of a formula in which you used an incorrect argument separator. For example, since the default argument separator is a comma, the cursor blinks if you use periods instead of commas, as in the following two formulas:

@DATE(89.6.20)

@IF(C1 = 10.999.555)

Blinking Cursor After a Comma

If a missing parenthesis caused the cursor to blink always at the end of the formula, you would have a definite clue to help search for the source of the trouble. But as it happens, a missing parenthesis sometimes causes the cursor to blink just after the next comma that follows the missing parenthesis rather than at the end of the formula.

For example, type the formula @IF (@SUM(D4..D6<352,99,88) in cell F2 and press Return. The cursor blinks just under the first 9 in 99. You might think this means that you need to enter a parenthesis or comma at this location, but in fact this indicates that you are missing a parenthesis somewhere before the comma preceding the blinking cursor. The formula needs a close parenthesis just after the cell reference D6. Once you enter the missing parenthesis, the formula returns the value 99, indicating that the sum of the range is less than 352.

Blinking Cursor After Close Parenthesis

If the cursor blinks after a close parenthesis, you may have entered an extra argument in an @function, which causes the cursor to blink under the

Cursor Blinks at Beginning of Range Address	
@SUM(AB7..ABC)	Incorrect range coordinate
@SUM(units)	No such range name exists in spreadsheet
Cursor Blinks at Start of @Function Name	
100+SUM(A7..A8)	Formula missing @ sign
@SU M(A7..A8)	Accidental space in @function name
@SUN(A7..A8)	@Function name misspelled
@SUM)A7..A8)	First close parenthesis should be open parenthesis
Cursor Blinks at Inappropriate Space	
@FIND("a",_B5,0)	Accidental space in @function range
Cursor Blinks at End of Formula	
@SUM(A7..A8 +10_	Missing close parenthesis
@ROUND(@SUM(A7..A8 ,0)+10_	Missing close parenthesis
@SUM(A7..A8))+100_	Extra close parenthesis
@SUM((A7..A8)+100_	Extra open parenthesis
@FIND("A" B5,0)+100_	Missing comma in @function
Cursor Blinks After Comma Following Missing Parenthesis	
@IF(@SUM(A7..A8 =0,99,88)	Missing close parenthesis
Cursor Blinks After Close Parenthesis	
@FIND("a",B3,0,0) +100	Too many arguments in @function
@IF(A1=0,@IF(B1=0,9,8,7),100)	Too many arguments in @function
@IF(@FIND("g",D3,0 ,9,8) +100	Missing close parenthesis
@ROUND(@IF(@ISERR(B7 ,9,8),0)	Missing close parenthesis
@FIND("a",B3) +100	Too few arguments in @function
Formulas That Return ERR	
@ROUND(88,200)	Can't round to 200 decimal places
@DATE(88,2,30)	February 30 is not a valid date
7/0	Can't divide by zero, a blank cell, or a label
@FIND("a",0,B3)	Arguments in incorrect order
+"Sales"&89	Can't concatenate a value and a string

Here are some typical examples of faulty formulas. Each shaded area indicates the location of an error. An underlined character shows where the cursor blinks.

character immediately following the @function. This occurs if you try to enter the formula @FIND("t",B3,0,0)+100 in cell F3. In this case, the extra zero causes the cursor to blink at the plus sign. Delete the last comma and the last zero within the parentheses and press Return. The formula returns 102.

As another example, type the following formula in cell F4:

@IF(C5>85,@IF(D5<120,1,2,3),100)

Press Return and you'll see that the unnecessary argument *3* causes the cursor to blink at the comma that follows the close parenthesis. Delete the last comma and the number 3 within the parentheses and press Return. The formula returns 1. Upon reviewing the correct order and type of @function arguments, you'll often locate the source of trouble.

Other instances of a blinking cursor that immediately follows a close parenthesis occur when the formula has a missing parenthesis. Type the following formula in cell F5:

@IF(@FIND("g",D3,0,9,8)+100

A close parenthesis is missing just after the first zero. Thus, when you press Return, the cursor blinks under the plus sign because *1-2-3* and *Symphony* think that you've specified too many arguments in the @FIND formula. Insert the missing close parenthesis, and the formula returns 109.

Now type the following formula in cell F6 and press Return:

@IF(B5>50,@IF(C5>85,9,8)),100)

The cursor blinks under the comma preceding the value 100. Although the problem is that there are more close than open parentheses, the cursor blinks at this point because *1-2-3* and *Symphony* think that the first @IF function is missing an argument. In other words, the extra close parenthesis signals the end to the @IF function, which doesn't really end until the final close parenthesis after the value 100. Press the Backspace key to delete the close parenthesis that is to the left of the comma and press Return. The formula returns 9.

As a final example of formulas with missing parentheses, type the following formula in cell F7:

@ROUND(@IF(@ISERR(B4,B5,B6),0)

When you press Return, the cursor blinks at the comma preceding the zero. In this case, a parenthesis is missing after the cell reference B4. Insert the close parenthesis after cell B4, press Return, and the formula returns 65. To *1-2-3* and *Symphony*, it seems that the @ISERR formula has too many arguments.

When a Formula Returns ERR

Sometimes when you attempt to enter a formula in a cell, *1-2-3* and *Symphony* accept the cell entry and then display ERR. The error occurs because the programs cannot interpret the formula you entered. For example, if you enter the formula @DATE(88,2,30) in a blank cell, you get ERR because February 30 is not a legitimate date. Another example occurs in the formula @ROUND (88,200). *1-2-3* and *Symphony* cannot round numbers to 200 decimal places.

A formula that attempts to divide by zero is a classic example of a formula that returns ERR. To generate this error, the formula may be dividing by a blank cell or by a cell containing either a zero or a label.

Specifying @function arguments in the incorrect order also causes ERR to appear. For example, the formula @FIND("n",0,A3) returns ERR because the second and third arguments are transposed.

ERR also results when you enter a formula that attempts to combine a string with a value. For example, you might try to enter this formula in cell F8:

```
+"Total"&" "&@SUM(A4..D6)
```

The correct formula, however, is the following:

```
+"Total"&" "&
  @STRING(@SUM(A4..D6),0)
```

The @STRING function converts the value returned by the @SUM formula into a label before concatenating it with the label *Total*.

ERR also appears if a formula refers to a cell that evaluates to ERR. You can avoid all of these errors by reviewing the documentation's or the Help facility's description of the arguments required for each @function that you plan to use.

Three Ways to Debug a Formula

Now that you know the types of clues that various errors generate, here are some tips for remedying the problems. The secret to debugging a formula is to break it into parts and then check it either from left to right, from inside out, or from outside in. To check a formula, first convert it into a label.

If the program won't let you enter the formula, press the Home key to move the cursor to the beginning of the formula. Then type an apostrophe and press Return. Now the actual formula appears as a label in the cell. If you enter a formula that returns ERR, move the cell pointer to the cell containing the formula, press the EDIT key, and then press the Home key. This moves the cursor to the beginning of the formula. Type an apostrophe and press Return. Once the formula is a label, you can copy it to a few cells and debug the copies.

Some formulas can be split neatly into halves. These usually consist of two formulas that are joined by a mathematical operator. For example, consider the following formula:

```
@MAX(@SUM(A4..A6),
  @SUM(B4..B6))
  +@MIN(@SUM(C4..C6),
  @SUM(D4..D6)
```

You have two nested formulas joined by a plus sign. If you type this formula into cell A10 and press Return, you'll see that the cursor blinks at the end of the entire formula. That means there's a good chance that the problem is with the parentheses. But rather than hunt through the whole formula, pairing up parentheses, it may be easier to chop the formula in two and evaluate each half.

Convert the formula into a label as described above. Then select /Copy (in *Symphony*, MENU Copy), and copy cell A10 to range A12..A13. With the cell pointer in cell A12, press the EDIT key. A copy of the formula appears in the control panel. Press the Backspace key to delete everything up to the parenthesis that immediately precedes the plus sign. Then press the Home key, delete the apostrophe from the beginning of the formula, and press Return. Since *1-2-3* and *Symphony* accept the truncated formula, you know that the first half of the original formula is good.

Now move the cell pointer to cell A13. Press the EDIT key and then the Home key to move the pointer to the beginning of the formula. Delete everything up to and including the plus sign and then press Return. You'll hear a beep, and the cursor will blink at the end of the formula. You can conclude, therefore, that the problem rests with that half of the formula.

Since the cursor is blinking at the very end of the formula, the problem probably stems from the number of parentheses. Count the open and close parentheses, and you'll discover that there's one more open parenthesis than there are close parentheses. In fact, the formula is missing a final close parenthesis. Type one in and press Return. *1-2-3* and *Symphony* accept the truncated formula. Now move the pointer to the original formula in cell A10. Press the EDIT key and enter a final close parenthesis. Then press the Home key, delete the apostrophe, and press Return. *1-2-3* and *Symphony* accept the formula and return the value 419.88.

The second debugging strategy involves working on the formula from outside in. Use this method when you have a nested formula that you can strip apart, one level at a time. Consider the following formula:

```
@STRING(@ROUND(@MAX
  (@SUM(A4..A6),@SUM(D4..D6),2),0)
```

Type the formula in cell A15, press Return, and you'll see that the cursor blinks at the end of the formula. Press the Home key, type an apostrophe, and press Return to convert the formula into a la-

NOTE FOR USERS OF RELEASE 3

When using Release 3, you'll notice that many types of faulty formulas return the same symptoms that you encountered in earlier releases of *1-2-3*. These symptoms are described in the text of the article and listed in the accompanying table, both of which are based on the functionality of *1-2-3* Release 2.01.

You'll find that in some cases, however, Release 3 produces symptoms that differ slightly from those described in the text and listed in the table. Here are two examples of differences.

- Release 3 accepts a formula that contains a nonexistent range name and displays ERR in the cell.
- If you enter an @function with an extra blank space among the arguments, Release 3 closes up the extra space and accepts the formula.

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CIRCLE 117 ON READER SERVICE CARD

bel. Copy the formula from cell A15 to cell A17. Move the pointer to cell A17, and press the EDIT key and then the Home key. Now, working from the outside in, use the Delete key to delete the beginning @STRING formula and its open parenthesis. Press the End key, and use the Backspace key to delete the close parenthesis, the zero, and the comma. Press Return. *1-2-3* and *Symphony* won't accept the formula. Next press Home, and delete @ROUND and its open parenthesis. Then press the End key, and delete the close parenthesis, the number 2, and the comma.

When you press Return, *1-2-3* and *Symphony* still won't accept the formula. Press the Home key, and delete @MAX and its open parenthesis. Then press the End key, and you'll see that if you delete the close parenthesis, the @SUM will be missing a close parenthesis. This tips you off to the fact that the formula is missing a close parenthesis at that spot. Press Escape and move the pointer to cell A15, which contains the original copy of the formula. Press the EDIT key and then the Home key. Delete the apostrophe, insert the missing parenthesis right after the cell reference D6, and press Return. *1-2-3* and *Symphony* accept the formula and return the string 351.

The third technique involves working from inside out. The trick here is to substitute a simple value for each internal @function. Here's a formula to debug:

```
@IF(@SUM(A4..A6)>100,(@ROUND
   (@SUM(B4..B6),0),@SUM(C4..C6))
```

Type the formula in cell A19 and press Return. *1-2-3* and *Symphony* won't accept it. Press the Home key, type an apostrophe, and press Return to convert the formula into a label. Then copy cell A19 to cell A21. Move the cell pointer to cell A21. Press the EDIT key, and delete the third @SUM formula. In its place, enter the number 6. The formula now looks like this:

```
@IF(@SUM(A4..A6)>100,(@ROUND
   (@SUM(B4..B6),0),6)
```

Press the Home key, delete the apostrophe, and press Return. *1-2-3* and *Symphony* won't accept the formula. Now substitute the value 8 for the second @SUM formula. Here's how the formula looks:

```
@IF(@SUM(A4..A6)>100,
   (@ROUND(8,0),6)
```

After you make the substitution, *1-2-3* and *Symphony* still won't accept the formula. Substitute the value 150 for the first @SUM formula. *1-2-3* and *Symphony* still don't accept the formula, but now the formula is simple enough to easily pair up the parentheses. You'll see that the formula has an extra open parenthesis just before the @ROUND formula. Delete the spare parenthesis, press Return, and the abbreviated formula returns the value 8.

Now move the pointer to the original formula in cell A19. Press the EDIT key and then the Home key. Delete the apostrophe and the extra open parenthesis before the @ROUND function. *1-2-3* and *Symphony* now accept the formula, returning the value 257.1.

Easy Named-Range Editing

Here's one final tip for editing named ranges that are used in formulas. In *1-2-3* Release 2.01 or 2.2, when you move the cell pointer to a cell containing a formula that uses range names, the range names appear in the formula displayed in the control panel. But as soon as you press the EDIT key, these range names are replaced by their corresponding cell addresses.

To edit a range name rather than a range address, move the cursor to any position within the range coordinates and press the ABS key. The range coordinates convert to the corresponding range name. The only difference is that if the range name was originally absolute—that is, preceded by a dollar sign—it will now appear relative, and vice versa. Just edit the range name used in the formula, then delete or reenter the absolute cell reference. ■

E. Michael Lunsford is the developer of 101 Macros Plus for 1-2-3 *(Individual Software Inc.) and author of* The 1-2-3 Upgrade Guide *(1989, Bantam Electronic Publishing).*

@FUNCTIONS FROM SCRATCH

Turn 1-2-3 *formulas into fast, easy-to-use add-in @functions with* 3-2-1 Gosub.

BY MALCOLM JOHNSTONE

3-2-1 Gosub Developer Edition makes it possible to create your own add-in @functions for *1-2-3*. The advantages of replacing formulas with custom @functions are many:

- A custom @function is easier to enter than the complex formula it replaces.
- A custom @function dramatically reduces the chance of error because the formula on which it is based can't be changed during regular use.
- When you use a custom @function to replace a macro or a spreadsheet model, you save both recalculation time and memory.
- You can use a custom @function in any *1-2-3* Release 2/2.01 or 2.2 worksheet. In contrast, to use a formula from one worksheet in another, you have to resort to tricky File Combine operations.

Before *3-2-1 Gosub*, you could create add-in @functions with the Lotus Developer Tools, but you had to program them in assembly language. *3-2-1 Gosub* lets you create add-in @functions based on *1-2-3* formulas, so you don't have to learn a new programming language.

Here's how you do it:

1. Define a custom @function by writing one or more formulas. These formulas incorporate standard *1-2-3* operators and @functions, as well as some special *3-2-1 Gosub* @functions. You use more than one formula by arranging them in sequence, like lines in a *1-2-3* macro. You write them in contiguous cells in the same column. *3-2-1 Gosub* refers to these formulas as subroutines.

2. To test the formulas, you write yet another formula that returns the result of the formulas you wrote in step 1. This formula contains any arguments, or variables, that the @function will later accept. Arguments typically consist of ranges, values, or text strings.

3. Once you test the formulas, you use *3-2-1 Gosub* to convert, or compile, them into an add-in containing the @function. A single such add-in can contain up to 42 custom @functions.

The instructions in this article show how to use *3-2-1 Gosub* to create two @functions that calculate the effective interest rate of a loan or an annuity, given the nominal interest rate and the number of periods for which interest is compounded. As you read on, you'll understand why we show you two such @functions. If you have *3-2-1 Gosub*, you can follow the instructions and create the @functions yourself. If you don't, you can still read along to determine if you can benefit from the program.

Effective Interest

First, some definitions. The nominal interest is the stated annual interest rate for an annuity or loan. The effective interest rate, on the other hand, depends on the number of compounding periods. The more often the interest is compounded, the larger the principal becomes upon which interest is thereafter calculated, and the higher the effective interest rate will be. The formulas that you'll turn into @functions appeared in "When 10% Isn't 10%" (*LOTUS*, November 1988). For more information about nominal and effective interest rates, refer to that article.

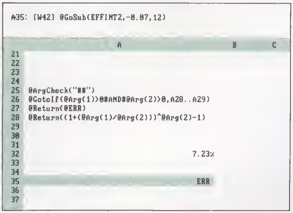
Following is the formula for effective interest rate:

$$\text{Effective Interest Rate} = (1+\text{Nominal Interest Rate}/\text{Periods per year})^{\text{Periods per year}} - 1$$

To get started, follow the instructions in *3-2-1 Gosub*'s manual to install the program. Part of *3-2-1 Gosub* is itself an add-in, and to create custom @functions, you must first attach that add-in to *1-2-3*. But when *3-2-1 Gosub*'s install program asks if you want the program to be attached automatically every time you start *1-2-3*, select No. You won't need to create @functions every time you use *1-2-3*, so it makes sense to attach *3-2-1 Gosub* only when you need it.

Now start *1-2-3*. Press Alt-F10 and select Attach. Select the 321GOSUB.ADN add-in and then select Quit.

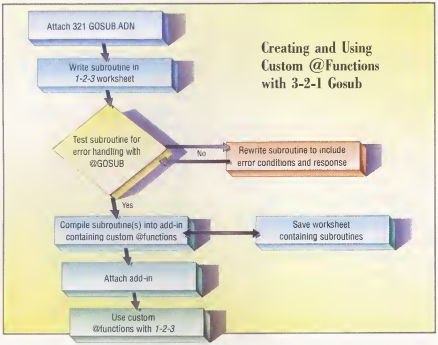
You'll be entering some long formulas into the cells in column A, so widen it to 42 characters: Press slash, select Worksheet Column Set-Width, enter 42, and press Return. You'll be calculating interest rates, which should be displayed as percentages, so set the worksheet's global format for percent: Select /Worksheet Global Format Percent and press Return. You'll want each formula you are about to enter to appear as text, not as the result each returns. Select /Range Format



```
A35: [W42] @GoSub(EFFINT2,-0.07,12)

                    A                          B        C
21
22
23
24
25  @ArgCheck("##")
26  @GotoIf(@Arg(1)>0#AND#@Arg(2)>0,A28..A29)
27  @Return(@ERR)
28  @Return((1+(@Arg(1)/@Arg(2)))^@Arg(2)-1)
29
30
31
32                                     7.23%
33
34
35                                       ERR
36
37
```

This subroutine created with *3-2-1 Gosub* calculates the effective interest rate of an investment, given the nominal rate and the number of periods per year. If one of its arguments is negative, it returns an error message (ERR).


Attach 321 GOSUB.ADN
Write subroutine in *1-2-3* worksheet
Test subroutine for error handling with @GOSUB
No
Rewrite subroutine to include error conditions and response
Yes
Compile subroutine(s) into add-in containing custom @functions
Save worksheet containing subroutines
Attach add-in
Use custom @functions with *1-2-3*

Creating and Using Custom @Functions with 3-2-1 Gosub

Text and specify range A1..A5. In the same way, format range A25..A28 as text. You'll be entering formulas in that range later.

Now name the range into which you'll enter the formulas that you'll later compile into an @function. Select /Range Name Create, enter *effint*, and specify range A5..A6. Note that although the formula you are about to enter occupies only one cell, the named range containing it must occupy at least two cells. That's a quirk that you'll have to remember when you use *3-2-1 Gosub*.

In cell A5 enter the following formula:

> @RETURN((1+(@ARG(1)/@ARG
> (2)))^@ARG(2)−1)

This formula defines what the custom @function will do, so let's examine it. @ARG and @RETURN are *3-2-1 Gosub* @functions you'll use often. @ARG accepts an argument from your custom @function. Since there are two distinct @ARG functions used here, @ARG(1) and @ARG(2), you can deduce that the @function, once created, will accept two arguments. @ARG(1) represents the first argument entered in the @function, which will be the nominal interest rate. @ARG(2) represents the second argument, the number of periods per year. @RETURN returns the result of the calculation to the cell in which you enter it and terminates the subroutine.

Your one-line subroutine is complete. You'll next test it by writing a formula that incorporates another of *3-2-1 Gosub*'s @functions, @GOSUB. In general, @GOSUB assumes the following syntax:

> @GOSUB(*range name,argument 1,*
> *argument 2,...*)

In this syntax, *range name* is the name of the range containing the subroutine, and the arguments are, in order, those referred to in that formula. @GOSUB can include any number of arguments. The limit on its length is the 240-character limit that applies to any cell in *1-2-3* Release 2/2.01 or 2.2.

To find the effective interest rate for 6% interest when compounded quarterly, you must refer to the range named *effint*, then use .06 as the interest-rate argument and 4 as the number-of-periods argument. Enter the formula @GOSUB (effint,.06,4) in cell A9. The result, 6.14%, displays as a percentage because you set the global default format to Percent.

Try out the subroutine two more times. First, determine the effective interest rate for 6% when compounded daily. To do so, enter the formula @GOSUB (effint,.06,365) in cell A12. The result should be 6.18%.

Next, try a negative interest rate. Enter the formula @GOSUB(effint,−.06,365) in cell A15. You should see a negative interest rate, −5.82%. This is mathematically correct, but is ridiculous in this context because no one lends money at a negative interest rate. This subroutine would serve you better if it returned an error message any time you enter a negative interest rate. Next you'll create a subroutine that will do just that.

Error Checking

Move the cell pointer to cell A25, select /Range Name Create, enter *effint2*, and then specify range A25..A28. Enter another of *3-2-1 Gosub*'s special @functions, @ARGCHECK ("##"), in cell A25. @ARGCHECK checks two things. It makes sure that your subroutine accepts only a specified number of arguments—in this case, two. It also makes sure that those arguments are of specific types. The two pound signs indicate that both are to be numeric values. You can use other symbols to check for strings or ranges.

Move the cell pointer to cell A26 and enter the following formula:

> @GOTOIF(@ARG(1)>0#AND#
> @ARG(2)>0,A28..A29)

In cell A27 enter @RETURN(@ERR). Then copy your original subroutine from cell A5 to cell A28.

Your new subroutine, *effint2*, includes four lines of formulas. *3-2-1 Gosub* reads a subroutine down a column, from one row to the next, until it encounters the last cell in a named range or a line containing the @RETURN function. *3-2-1 Gosub*'s @GOTOIF function lets you change the order in which it reads when certain conditions occur. The condition is spelled out in the formula that immediately follows the characters @GOTOIF.

That condition, expressed by the logical formula @ARG(1)>0#AND#@ARG (2)>0, is that both @ARG(1) and

DALE GLASGOW

@ARG(2) must be greater than zero. When both arguments are greater than zero, the formula further instructs *3-2-1 Gosub* to continue reading in cell A28, not in the cell directly below. The instruction to read in cell A28 is expressed as A28..A29 because you must specify a range of a minimum of two cells. Cell A28 contains the original subroutine that calculates the effective interest rate.

If either of the arguments is less than zero, the logical formula proves false. As a result, *3-2-1 Gosub* will ignore the instruction to continue at cell A28 and will continue on the next row instead. There, the formula @RETURN(@ERR) will return the value ERR to the @GOSUB formula. ERR tells you that something's amiss. Again, when *3-2-1 Gosub* reads any formula containing @RETURN, it won't read further, even if there is another formula in the cell beneath.

Now test the new subroutine. In cell A32 enter a formula to determine the effective interest rate of a 7% annuity compounded monthly. The formula is @GOSUB(effint2,.07,12). The result should be 7.23%. Next, test it with a negative interest rate by changing the argument .07 to −.07. It should return ERR.

From Subroutine to @Function

With your subroutines written and tested, all that remains is to compile them into an add-in. You use *3-2-1 Gosub*'s compiler by typing a command at the DOS prompt.

Make sure the directory containing *3-2-1 Gosub* is the current directory. Then select /File Save and enter *finance* to save your worksheet as FINANCE.WK1. Next, select /System to exit to DOS. At the DOS prompt, type *atmake finance r=effint r=effint2* and press Return. *3-2-1 Gosub* will create an add-in called FINANCE.ADN, which contains the @functions @EFFINT and @EFFINT2. Enter *exit* to return to *1-2-3*, and select /Worksheet Erase Yes to obtain a fresh worksheet. Press Alt-F10 and select Attach. You should find FINANCE.ADN among the add-ins listed. Select it, then select Quit.

Try out the @functions you've just created, using the syntax @EFFINT(*arg1, arg2*) or @EFFINT2(*arg1,arg2*), where *arg1* is the nominal interest rate and *arg2* is the number of compounding periods in a year. Note that you must have the FINANCE.ADN attached to *1-2-3* in order for these @functions to work.

You can compile a worksheet containing more than just two subroutines. *3-2-1 Gosub* lets you create as many as 42 @functions in a single compilation. Strictly speaking, you can't add new @functions to an existing add-in. However, in practice it's easy to do. Keep the original worksheet from which you compiled your add-in. If you want to add more @functions to the add-in, write new subroutines on the worksheet, then recompile that worksheet, specifying the range names of the new subroutines in addition to the old ones.

3-2-1 Gosub can take you beyond the simple @functions you created here. The program contains special @functions to create @functions that perform complex calculations and manipulate data (see the box to the left). The program comes with 48 sample @functions created with *3-2-1 Gosub* and worksheets containing the formulas used to create them. ■

Malcolm Johnstone works for Lotus Selects.

SPECIAL @FUNCTIONS IN 3-2-1 GOSUB

Macro and formula experts can use *3-2-1 Gosub* @functions to turn complex spreadsheet applications into custom @functions.

@ Passes the specified arguments to your subroutine and calculates the subroutine. Used to test a subroutine before compiling.

@ARG Returns either the *n*th argument passed to a subroutine or the number of total arguments passed to a subroutine.

@ARGCHECK Verifies the number and type of arguments passed to a subroutine. Provides a way for the @function to detect and respond to incorrectly entered arguments.

@ASSIGN Assigns a value to a variable cell. Used to create incremental counters in loops and to assign values during iterative calculations.

@DEBUG Turns the printing of trace information on or off. Used with @PRINT to debug a subroutine.

@GOSUB Same as @ defined above.

@GOTOIF Tests for a specific condition. If the condition is met, this @function moves execution of the subroutine to the range specified as the second argument. If the condition is false, execution proceeds to the range specified as the third argument or to the next line if no third argument is specified.

@ISRANGE A logical function that returns 1 if an argument passed to a subroutine is a range, 0 if it is not.

@PRINT Pauses during the recalculation of a subroutine to display the current argument and its cell coordinates in the control panel. Used with @DEBUG to debug a subroutine.

@RETURN Terminates execution of the subroutine and returns a value. The value can be specified as a string, a range, a predetermined numerical value, or the result of a formula entered as the argument of the @function.

@SUBCOL Returns a single-column subset of a specified range. Used with @ASSIGN to store values in a range of cells.

@SUBROW Returns a single-row subset of a specified range. Used with @ASSIGN to store values in a range of cells.

IN BRIEF

3-2-1 Gosub Developer Edition, Version 1.0. Frontline Systems Inc., 140 University Ave., Suite 100, Palo Alto, CA 94301; 800-451-0303, ext. 55; in the U.S. and Canada, 916-677-7171, ext. 55. Requires MS-DOS 2.0 or higher, *1-2-3* Release 2/2.01 or 2.2, and 3K of RAM beyond that of *1-2-3* and the Add-in Manager. Released 3/89. $249.95. 90-day limited warranty on disk media; 90-day free telephone support.

ANSWERS TO YOUR QUESTIONS ABOUT LOTUS PRODUCTS

SYMPHONY

PRINTING ON LETTERHEAD

Q. I have a problem printing on letterhead stationery from a DOC window. I set the top margin in the print settings so that *Symphony* will start printing below the letterhead. But each succeeding page has a wide gap at the top because the stationery's second page lacks the letterhead design. How can I get around this problem easily?

Richard Bannister
Big Wheels Transport & Leasing Ltd
Prince Edward Island, Canada

A. There is a simple solution. Don't change the margin settings at all from the default. Rather, precede your letter in the DOC window with several blank lines. These will signal the printer to move the paper up past the letterhead. The balance of the letter will print beginning at the tops of subsequent pages.

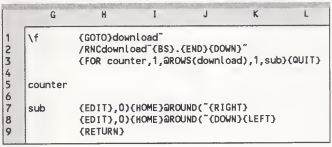
1-2-3/SYMPHONY

ROUND COLUMNS OF NUMBERS FASTER

Q. I regularly download 350 to 375 rows of data in two columns from a mainframe. Then I round all these numbers to whole numbers because merely suppressing the display of the decimal places isn't enough and might cause problems in later calculations.

I use the macro at the top of the next column to round the numbers, but it's very slow. There must be a faster way.

M. Chris Duel
Warren's Turf Nursery
Crystal Lake, Ill.



```
           G         H         I         J         K         L
1   \f        {GOTO}download~
2             /RNCdownload~{BS}.{END}{DOWN}~
3             {FOR counter,1,@ROWS(download),1,sub}{QUIT}
4
5   counter
6
7   sub       {EDIT},0){HOME}@ROUND(~{RIGHT}
8             {EDIT},0){HOME}@ROUND(~{DOWN}{LEFT}
9             {RETURN}
```

A. There are several ways to round the numbers more quickly than your macro can. The simplest way is to write and copy a formula, then use the Range Value (in *Symphony*, Range Values) command to convert the formula and its copies into their current values.

Let's say that the downloaded data is in range A1..B350. First move the cell pointer to cell C1 and enter the formula @ROUND(A1,0). Then copy the formula to range C1..D350.

To convert the formulas to values, select /Range Value (in *Symphony*, MENU Range Values). Indicate range C1..D350 as the range to copy from and cell A1 as the range to copy to. Then clean up the worksheet by erasing the formulas in columns C and D.

I NEED TO FILL A COLUMN WITH LIST NUMBERS

Q. Can you use the Data Fill (in *Symphony*, Range Fill) command to enter a series of numbers followed by a right parenthesis? I'd like to quickly enter the series 1), 2), 3), 4), and so on in a single column.

Lisa Buttiglieri
Structure Tone Inc.
Boston, Mass.

A. There are five major steps to filling a column as you've described. To do this quickly, you must have two blank columns available side by side. We'll use columns A and B for this discussion.

1. Fill column A with the number series you desire. For example, select /Data Fill (in *Symphony*, MENU Range Fill) and indicate the range A1..A10. Enter 1 as the start number and press Return twice to accept the default step and stop numbers.

2. Enter the following formula in cell B1 and copy it down the column:

@STRING(A1,0)&")"

To copy the formula, select /Copy (in *Symphony*, MENU Copy), indicate cell B1 as the cell to copy from and range B2..B10 as the range to copy to.

3. Copy the current values of the formulas back into column A. To do this, select /Range Value (in *Symphony*, MENU Range Values) and indicate range B1..B10 as the range to copy from. Then indicate cell A1 as the range to copy to.

4. Erase the formulas from column B. You do this by selecting /Range Erase (in *Symphony*, MENU Erase) and indicating range B1..B10.

5. Realign the labels in column A: Select /Range Label Right (in *Symphony*, MENU Range Label-Alignment Right) and indicate range A1..A10.

This procedure may seem complex, but after you've done it a few times, it's not so bad. If you need this listing often, why not create a very long version of it in a blank worksheet and save it on disk. Then, rather than create it again from scratch, you can use the File Combine Copy command to bring the existing list from disk into the current worksheet. If the original list has too many entries for your current application, simply erase the ones you don't need.

@ISNUMBER DOES NOT EQUAL @ISBLANK

Q. The @ISNUMBER function returns 1 when the cell it refers to contains a number or is blank. The @ISSTRING function returns 1 only if the referenced cell contains a label. Can the @ISNUMBER function return 1 only if it refers to a cell that contains a number? I'd like to avoid using lengthy @IF statements.

Abdul Nasser
Lincoln Land Community College
Springfield, Ill.

A. In school we are taught that the absence of a number doesn't necessarily imply a zero. Nothing is nothing, and zero is zero. However, many computer programs call this concept into question. *1-2-3* and *Symphony*, for example, consider blank cells to be numerically equivalent to zero.

This being the case, there is no single expression that returns 1 only if a cell contains a numeric entry. The following formula is the shortest one we could devise to accomplish the task:

@ISNUMBER(A1)*(@CELL
("type",A1..A1)="v")

It returns 1 if cell A1 contains any numeric entry and 0 if cell A1 is blank or contains a label. This method does not work in *1-2-3* Release 1A.

DISPLAY POSITIVE AND NEGATIVE SUM SIGNS

Q. Can *1-2-3* or *Symphony* do a calculation like the one shown below?

Maine	5.10
Conn	4.25
Mass	−6.50
Vermont	−2.85
	±9.35

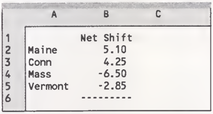
I want to sum the positive and the negative values and display the appropriate signs in front of the results.

Collin Robinson
Union Trust Co.
Shelton, Conn.

A. It's not entirely clear what you wish to accomplish. Summing the negative values in a column separately from the positive values is not a problem. However, returning the results in a single cell may not make sense.

In your example, the sum of the positive values equals the absolute value of the sum of the negative values. Is this always the case? If it is, you don't need to sum the negative values at all. You really need a way to sum the positive values and display the plus/minus sign in front of the result.

In any case, you can sum the negative or the positive values by creating a Criterion range and writing an @DSUM formula. For all of this to make sense, create the following worksheet:



	A	B	C
1		Net Shift	
2	Maine	5.10	
3	Conn	4.25	
4	Mass	-6.50	
5	Vermont	-2.85	
6		---------	

Enter the labels shown in range A2..A5 and in cell B1. To enter the dashed line in cell B6, move the cell pointer to cell B6, type a backslash followed by a hyphen, and press Return. Then enter the values shown in range B2..B5. Format the cells in range B2..B8 by selecting /Range Format Fixed (in *Symphony,* MENU Format Fixed), accepting the default of 2, and indicating the range.

To create a Criterion range, copy the label from cell B1 to cell D1. Then enter the formula +B2>0 into cell D2. Now enter the formula @DSUM(B1..B5,0, D1..D2) into cell B7.

The formula returns 9.35, which represents the sum of the positive values in column B.

To calculate the sum of the negative values, you need to create a second Criterion range. First copy the label from cell D1 to cell D4. Then enter the formula +B2<0 into cell D5. Finally, enter the formula @DSUM(B1..B5,0,D4..D5) into cell B8. This formula calculates the sum of the negative values in column B.

If you wish to calculate only the sum of the positive values and to display the plus/minus sign in front of the result, forego the second Criterion range and the formula that calculates the sum of the negative values. Create the first Criterion range as described, and enter the following formula into cell B7:

+"   ±"&@STRING(@DSUM
(B1..B5,0,D1..D2),2)

Note that to create the plus/minus sign, you press the COMPOSE key and type a plus sign followed by a minus sign. Also note that three spaces precede the plus/minus sign in our formula. These spaces align the formula's resulting label with the numbers in the column above. You may need more or fewer spaces, depending on the column's width and the maximum number of digits that will appear in the formula's result.

For more information, refer to your documentation manual. It contains an explanation of the @DSUM function and associated Criterion ranges.

1-2-3

WHY SORT FORMULAS?

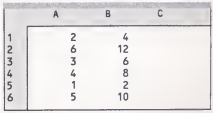
Q. I often sort one-column data ranges. Some of the columns I wish to sort contain only formulas. However, the Data Sort command has no effect on these columns. Rather than displaying an error message, the command appears to be working, but finishes with no result.

I've used the Data Sort command within a macro, and I don't want to add a File Xtract Values routine. An alternative suggestion would be helpful.

Michael P. Caligiuri
University Of California
La Jolla, Calif.

A. Actually, *1-2-3* Releases 2, 2.01, and 2.2 sort the formulas in a column when you issue the Data Sort command. The formulas receive new locations in the column, based on their values when you issue the command. However, the effect of sorting isn't the same as the effect of moving a formula. Rather, it equals the effect of copying a formula.

The moment a sorted formula reaches its destination, *1-2-3* adjusts the formula's references and then recalculates it. Suppose, for example, that your worksheet looks like the one in the following illustration:



	A	B	C
1	2	4	
2	6	12	
3	3	6	
4	4	8	
5	1	2	
6	5	10	

The entries in column A are values, and the entries in column B are formulas. To create the formulas, we entered +A1*2 in cell B1 and copied it to range B2..B6. When you sort column B in ascending order, *1-2-3* copies the formula from cell B5 to cell B1, from cell B1 to cell B2, and so on.

However, the formulas' references adjust immediately and end up referring to the adjacent cells of column A. The worksheet looks similar, but the formulas are in a new order.

Test this point by changing a single formula. For example, create the worksheet as it appears, and change the formula in cell B1 to read +A1*10. Because the formula results in a larger number, expect it to sort to the last position in the list when you select an ascending sort order. Sorted to the end of the list, the formula then refers to cell A6. Cell B6 now evaluates to 50. Because of this behavior of the Data Sort command, in most cases sorting formulas makes no sense.

If you want to sort the formula's results, you must convert the formulas to values before you issue the Data Sort command. But you don't need to extract values to a file to make the conversion. Use *1-2-3*'s Range Value command. To convert a column of formulas into values, select /Range Value and indicate the column of formulas as the range to copy from. Then indicate the column's first cell as the range to copy to.

KEEP PARSED DATA ALIGNED

Q. Sometimes I import several files from a mainframe into a spreadsheet. I import a file of long labels to a specific row and column. Then I use the Data Parse command to place each field into its own column.

When I import a second file to the right of the first file in the worksheet, the Data Parse command moves the first data set down a row. I end up moving the data back up in the worksheet to keep the files aligned.

Is there some way to use the Data Parse command so that all the parsed data begins in the same row?

Jerry Kantor
Colorado Interstate Gas Co
Colorado Springs, Colo

A. It sounds as if you specify the same range as both your Input column and Output range. Choose a separate area of the worksheet as the Output range. For example, if each file you import is 22 lines long, specify row 25 as the Output range for the first set of data you parse. Import the second file to the right of the first file in the worksheet, and issue the Data Parse Format-Line Create command again. The parsed data that was in row 25 moves down to row 26, so specify row 26 as the Output range for the second set of data. Repeat this procedure for each file.

After you have imported and parsed all of your data, delete the rows that contain the format lines and imported files.

LIMITED SPREADSHEET

Q. I run *1-2-3* Release 2 on an IBM PC XT with 1 megabyte of expanded memory. I've created a spreadsheet that has 39 columns and 809 rows. When I use the Worksheet Insert Row command to add rows, *1-2-3* displays the error message *Cannot move or copy data beyond worksheet boundaries.*

I can't find this message in any books about *1-2-3*, and there seems to be plenty of memory in which to expand this spreadsheet. Can you shed some light on my problem?

L. A. Meyers
FM 1960 Pediatric Center, P.A.
Houston, Tex.

A. You get that error message if inserting rows would move any data cell beyond the bottom border of the worksheet. In *1-2-3* Release 2.01 this error message also appears if a formatted cell would move beyond the border.

To eliminate the problem, delete all the rows below the worksheet data you wish to retain. In your case, delete rows 810 through 8192. First make sure there's nothing worth saving in those rows. Then select /Worksheet Delete Row and indicate range A810..A8192.

Deleting the rows removes extraneous data and all cell formats assigned by the Range Format command. You should then be able to insert new rows at will.

In *1-2-3* Release 1A, the limit is 2,048 rows and the comparable error message is *Worksheet Full*. In *1-2-3* Release 2 the error message *Worksheet Full* appears if a formatted cell would move beyond the border.

ERRONEOUS @FUNCTION

Q. I've found an error in a sample *1-2-3* worksheet. When I run the macro in this sample sheet, it crashes with the error message *Macro: Invalid expression in IF (B75).*

I found that the macro contains the command {IF @ISAPP("speedup")}—apparently entered by accident in place of the expression {IF @ISERR("speedup")}. I tested the worksheet on two other computers running different *1-2-3* packages and got the same results. Normally, *1-2-3* doesn't let you enter an erroneous @function, but this bug must have evaded the quality-control people.

Patrick A. Thrasher
Florida Department of Transportation
Gainesville, Fla

A. You haven't discovered a bug. @ISAPP has been around for a while, but you can use it only if you've added the Add-In Manager to your driver set.

You obtain the Add-In Manager when you buy any of the commercially available add-ins—programs that "hook" into *1-2-3* and act as if they were built into the product. Your demonstration worksheet assumes that you are using the add-in *Lotus Speedup* from Lotus Development Corp.

When your driver set contains the Add-In Manager, the expression @ISAPP ("speedup") returns 1 if *Speedup* is attached and 0 if it is not. When the Add-In Manager isn't in your driver set, the @ISAPP function is meaningless to *1-2-3*. If you retrieve a worksheet that contains the function in a formula, *1-2-3* converts the function to read @?("speedup"), and the function returns NA.

The macro in the sample worksheet returns an error message because your driver set doesn't contain the Add-In Manager.

USING DATES ON THE X AXIS OF AN XY GRAPH

Q. If I use date values for the X axis when creating an XY graph in *1-2-3* Release 1A, the year appears as 00 instead of 88 (for 1988), and the scale indicator shows the dates to be in the thousands. It's equally annoying that the dates on the axis scale run together and are difficult to read when I create a line graph. I've entered the dates correctly, and I am using the Graph Options Scale X-Scale Format Date command string. Am I doing something wrong?

D. K. Schattner
Charlotte, N.C.

A. You should not use dates on the X axis of an XY graph in any release of *1-2-3*. For an XY graph, your software pairs each value from the X range with corresponding values from ranges A through F and plots the intersection of the two values on the graph. A date in the spreadsheet consists of a serial number that represents the numbers of days that have passed since January 1, 1900. Generally, this is a five-digit number. For display purposes, your software plots these large values to scale as small numbers and alerts you by displaying *(Thousands)* below the X axis.

To work with dates on the X axis, select Line instead of XY as the graph type. List the dates for the X axis in a worksheet range and specify that range as the X range.

When too many items appear on the X axis, the items run together. To avoid this, select /Graph Options Scale Skip (in a *Symphony* SHEET window, select MENU Graph 2nd-Settings Other Skip). You can enter a skip factor from 1 to 8192. A skip factor of 2 causes the X axis to display every other axis label, allowing more room for the other items. The Skip command has no effect on what data appears in the graph itself.

WHAT DO YOU USE ZAP FOR?

Q. What's the purpose of the ZAP.COM file?

Mark Fevola
Kenilworth, N.J.

A. The file named ZAP.COM comes with *1-2-3* Release 2.01. It's there for people who upgrade from Release 2.

When you installed *1-2-3* Release 2, you had the opportunity to transfer copy-protection information to your hard disk. This "hard-disk-install" procedure lets you run the program without putting the *1-2-3* System Disk in your computer's A drive.

The procedure that installs *1-2-3* Release 2 on your hard disk transfers a hidden file to the designated directory. The DOS DEL or ERASE command can't remove a hidden file from a disk. However, the ZAP.COM program in the Release 2.01 package can remove the hidden file.

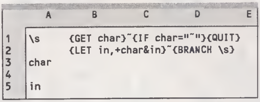
CONTEST

JUNE CONTEST RESULTS

In the June issue we asked users of *1-2-3* Release 2/2.01 and *Symphony* to submit the best method for reversing a series of characters. For example, if you enter *ABCDEFGHIJKLMNOPQRSTUVWXYZ*, your method will return *ZYXW VUTSRQPONMLKJIHGFEDCBA*. If you enter *How are you doing today?*, your method will return *?yadot gniod uoy era woH*.

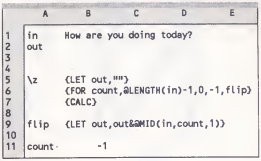
Some readers used tables that contain string @functions that evaluate as far down as there are characters. Others used various methods including Range Transpose or Data Sort commands. These methods tend to require more time and memory than necessary.

One reader's interpretation differed from what we intended. We used the word *enter*, which means "type the entire phrase and then press Return." The reader's macro reverses the phrase as you type each character. To try it, enter the labels in range A1..B5 as in the figure below. Enter an apostrophe label prefix in cell B5. Press slash (in *Symphony*, MENU), select Range Name Labels Right, and indicate range A1..A5. With the cell pointer in cell B5 (or any blank cell), hold down the MACRO key (Alt on most computers) and press S. Press Return to end the macro.



```
          A          B           C           D          E
1   \s        {GET char}~{IF char="~"}{QUIT}
2             {LET in,+char&in}~{BRANCH \s}
3   char
4
5   in
```

Although this method works well, it's not what we had in mind. We found the fastest solution to be the macro at the top of the next column.



```
        A         B          C          D          E
1   in      How are you doing today?
2   out
3
4
5   \z      {LET out,""}
6           {FOR count,@LENGTH(in)-1,0,-1,flip}
7           {CALC}
8
9   flip    {LET out,out&@MID(in,count,1)}
10
11  count·        -1
```

Enter the labels in range A1..B11. Do not enter the value in cell B11. Assign the labels in column A as range names for the adjacent cells in column B: Press slash (in *Symphony*, MENU), select Range Name Labels Right, and indicate range A1..A11. To try the macro, press MACRO-Z. Here's how the macro works:

{LET out,""} stores a label prefix in *out* (cell B2).

{FOR count,@LENGTH(in) − 1,0, − 1, flip} causes the macro *flip* to process one time for each character in the input string. The cell named *count* monitors the repetition that the macro is executing. The loop starts with the result of @LENGTH(in) − 1. If *in* contains *How are you doing today?*, @LENGTH(in) − 1 evaluates to 23. The stop value is 0 and the step value is − 1. Prior to each subsequent pass through the loop, the macro reduces the value of *count* by 1.

The subroutine named *flip* contains {LET out,out&@MID(in,count,1)}. After the first pass, the program enters the last character of *in* into *out*. This statement appends the next-to-last character in the string during the second pass through the loop, the third character from the end during the third pass through the loop, and so on.

{CALC} recalculates the worksheet to display the result in *out*.

The following readers submitted winning entries: Thomas Berent, Lancaster, N.Y.; Gary Bernstein, Los Angeles, Calif.; W. R. Berry, Tucker, Ga.; Pete Black, Huntsville, Ala.; Jeff Bloom, Anaheim Hills, Calif.; Tanh Bui, Anderson, Ind.; Rebecca Cahlik, LaVerne, Calif.; Dave Carlson, Waynesville, Mo.; Rex Clingan, Maryland Heights, Mo.; Steven Stewart Cobb, Louisville, Ky.; Michael Harris, Houston, Tex.; Brooks Hartzell, Indianapolis, Ind.; Terry Hausmann, Morris, Minn.; Sean Henry, Plano, Tex.; Greg Jones, Salem, Oreg.; Loren Krienke, San Diego, Calif.; Kurt Kunz, Bismarck, N.Dak.; Pam Lash, Radnor, Pa.; Tom Masters, Charlotte, N.C.; Billie Jo McDaniel, Dallas, Tex.; Mark Rochon, Foster City, Calif.; John Schiener, Lake Worth, Fla.; William Spicer, Danville, Ill.; Dwayne Wacenske, Cleveland, Ohio; Paul Wilkerson, San Angelo, Tex. ■

This material was prepared by Daniel Gasteiger and the Technical Editors.

WRITE US

Do you have a question? We can't answer every letter, but if yours is selected, we'll publish it along with an answer or a request to other readers for advice. We'll pay $25 for each letter we publish. Send your letters, including your address and daytime phone number, to: Q&A, LOTUS Magazine, P.O. Box 9123, Cambridge, MA 02139–9123.

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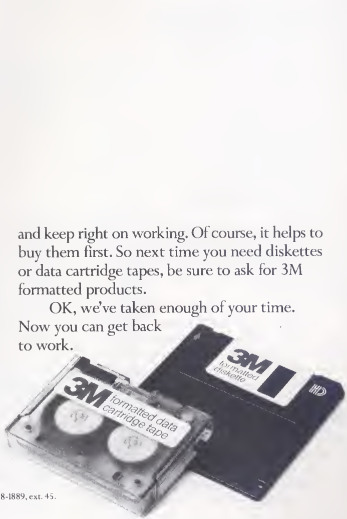

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REVISITED

FORMULA TO DISPLAY CURRENT MONTH AND YEAR

Like John Brown [March], I also need the current month to appear in my monthly report headings. To avoid having to enter the month and year each time I generate a new report, I use the following formula:

```
+“Report for ”&@CHOOSE
  (@MONTH(@NOW)–1,“January”,
  “February”,“March”,“April”,
  “May”,“June”,“July”,“August”,
  “September”,“October”,
  “November”,“December”)&
  “ ”&@STRING(1900+@YEAR
  (@NOW),0)
```

For example, this formula evaluates to *Report for July 1989* when I retrieve the worksheet any day in July. I never have to remember to edit the headings for my monthly reports.

Jerry Martin
Sherwood, Ark

This formula does not work in 1-2-3 *Release 1A.*

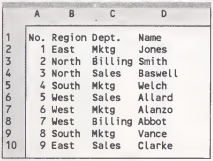
FASTER WAY TO SORT ON MORE THAN TWO KEYS

I found a faster way to sort on more than two keys [March]. Use an additional column as the primary sort key. Before using this technique, you need to determine the order in which you want the fields to be sorted.

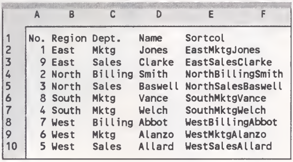
Suppose you want to sort the data in the following figure alphabetically by region, department, and name. Create an additional field in column E and enter the field name *Sortcol* in cell E1. Enter the formula +B2&C2&D2 in cell E2.

Copy this formula from cell E2 to range E3..E10. Place the cell pointer on cell E2, select /Range Value (in *Symphony*, MENU Range Values), and specify range E2..E10 as the From range. Press Return to accept cell E2 as the To range.

Now, select /Data Sort Data-Range, specify range A2..E10, select Primary-Key, specify cell E2, enter A for ascending order, and then select Go (in *Symphony*, MENU Query Settings Basic Database, specify range A1..E10, select Quit Sort-Keys 1st-Key, specify cell E2, press Return to accept A for ascending order, select Quit Record-Sort All Quit). *1-2-3* and *Symphony* return the database sorted by region, department, and name, as shown in the second figure. Finally, erase range E1..E10.



	A	B	C	D
1	No.	Region	Dept.	Name
2	1	East	Mktg	Jones
3	2	North	Billing	Smith
4	3	North	Sales	Baswell
5	4	South	Mktg	Welch
6	5	West	Sales	Allard
7	6	West	Mktg	Alanzo
8	7	West	Billing	Abbot
9	8	South	Mktg	Vance
10	9	East	Sales	Clarke



	A	B	C	D	E	F
1	No.	Region	Dept.	Name	Sortcol	
2	1	East	Mktg	Jones	EastMktgJones	
3	9	East	Sales	Clarke	EastSalesClarke	
4	2	North	Billing	Smith	NorthBillingSmith	
5	3	North	Sales	Baswell	NorthSalesBaswell	
6	8	South	Mktg	Vance	SouthMktgVance	
7	4	South	Mktg	Welch	SouthMktgWelch	
8	7	West	Billing	Abbot	WestBillingAbbot	
9	6	West	Mktg	Alanzo	WestMktgAlanzo	
10	5	West	Sales	Allard	WestSalesAllard	

Ken Vitoff
Spring Hill, Fla

This technique does not work in 1-2-3 *Release 1A.*

In 1-2-3 *Release 3 you can use up to 255 sort keys to sort data.*

1-2-3

UNDO ERASED FORMULAS

Sometimes I accidentally erase a lengthy formula and wish I could undo my mistake. If I had previously saved the file, I could just retrieve it. But if I had made subsequent changes that I had not yet saved, I would lose those changes.

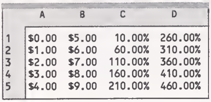
I could try to re-create the formula, but instead I use this technique. I place the cell pointer on the cell that was erased or altered. I then select /File Combine Copy Named/Specified-Range, enter that cell's address, and at the prompt, enter the name of the file that I am working on. *1-2-3* restores the formula that was in that cell.

Anita L. Newton
Mesa, Ariz

RETAINING NUMERIC FORMATS IN PRINT FILE

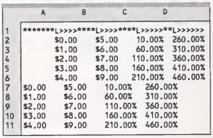
I recently had to convert a 200-record *1-2-3* database to a *WordPerfect* 5.0 document. I had no difficulty translating the worksheet file to a DIF file using the *1-2-3* Translate utility. Nor did I have any trouble using the WordPerfect Convert program to convert the DIF file to *WordPerfect*'s format. By doing this, however, I lost all numeric formats in the translations. I considered creating a macro to convert the numbers to labels but found a much faster and easier solution. For example, suppose you have a file with data such as that shown in the figure at the top of the next page.

Select /Print File and enter *numbers.*



```
     A       B         C          D
1  $0.00   $5.00    10.00%   260.00%
2  $1.00   $6.00    60.00%   310.00%
3  $2.00   $7.00   110.00%   360.00%
4  $3.00   $8.00   160.00%   410.00%
5  $4.00   $9.00   210.00%   460.00%
```

Choose Range and specify A1..D5, then select Options Other Unformatted Quit Align Go Quit. This will create an ASCII file called NUMBERS.PRN. Select /Worksheet Erase Yes to clear the worksheet. Choose /File Import Text and enter *numbers.prn* to bring in the PRN file you just created. Each row of numbers in all columns is now displayed as one long line of labels in column A. With the cell pointer in cell A1, select /Data Parse Format-Line Create. Select Format-Line Edit, change all the Vs for values to Ls for labels, and press Return. Select Input-Column and specify range A1..A6. Then select Output-Range, specify cell A7, and select Go. *1-2-3* parses the data into separate columns and changes the numbers to labels, yet retains the numeric formats, as you can see in the following figure.



```
        A          B          C          D
1   ********L>>>>****L>>>>****L>>>>>**L>>>>>>
2           $0.00      $5.00     10.00%  260.00%
3           $1.00      $6.00     60.00%  310.00%
4           $2.00      $7.00    110.00%  360.00%
5           $3.00      $8.00    160.00%  410.00%
6           $4.00      $9.00    210.00%  460.00%
7   $0.00      $5.00      10.00%    260.00%
8   $1.00      $6.00      60.00%    310.00%
9   $2.00      $7.00      110.00%   360.00%
10  $3.00      $8.00      160.00%   410.00%
11  $4.00      $9.00      210.00%   460.00%
```

Delete rows 1 through 6, save this worksheet under a new name, and translate this file to DIF.

Anita L. Newton
Mesa, Ariz.

This technique does not work in 1-2-3 *Release 1A.*

PRINTING PROBLEM ON IBM TOKEN RING LAN

Many PC users in my company experienced a problem printing to a shared printer on the IBM Token-Ring Network with the IBM PC LAN Program. After a user specified the Print range and selected Align Go Page, the file to be printed seemed to hang in a spooling state on the print server. The only way to break out of the print lockup was to exit from *1-2-3* or press a keyboard combination that caused a forced end of job.

My solution was to configure the default printer interface in *1-2-3* as DOS Device LPT1 Interface Choice 5. We had configured *1-2-3* on all the PCs with the default printer interface set to Parallel 1 or Choice 1. After you set the default printer interface to 5, select Quit Update Quit. When you select Align Go Page from the Print menu, *1-2-3* properly closes the file to be printed so that the print spool on the LAN can release the file and send it to the shared printer.

Jeffrey Rezab
St Paul Companies
St. Paul, Minn.

This applies only to 1-2-3 *Release 2/2.01. This solution also corrects the same problem on a 3Com LAN with the 3Com 3+ or the 3+Open LANManager operating system.*

1-2-3/SYMPHONY

FORMULA TO FIND PREVIOUS SUNDAY'S DATE

In our office we close out data capture each week as of Sunday and need to include the closing Sunday's date on all our progress reports. I use the following formula to have *1-2-3* automatically determine the closeout date:

```
@IF(@MOD((@NOW-32446),7)
  <>0,(@NOW-@MOD((@NOW
  -32446),7)),@NOW)
```

The value 32446 is the serial number for an arbitrarily chosen Sunday. The formula works as follows: The first part of the formula determines if today is a Sunday. That is, it determines the difference in days between today and the arbitrarily chosen Sunday's serial number and then it uses the @MOD function to divide the difference by 7. If there is a remainder, then today is not a Sunday and the second argument of the @IF formula will evaluate to the previous Sunday's date. If there is no remainder, then today is a Sunday and the formula evaluates to today's date.

To set the cell's format to MM/DD/YY, select /Range Format Date 4 (in *Symphony*, MENU Format Date 4).

John F. Judge Jr.
U.S. Bureau of the Census
Suitland, Md.

You must select the serial number for a Sunday that is before the current date in order for the formula to correctly return the previous Sunday or the current date if it is a Sunday. If the arbitrarily chosen Sunday is a date before @NOW, the formula returns the most recent Sunday. If the arbitrarily chosen Sunday is after the current date, the formula will evaluate to the next Sunday's date.

The Date 4 format and the @NOW function are not available in 1-2-3 *Release 1A. Substitute the Date 1 format and @TODAY for comparable results.*

This technique also works in Symphony; *however, the future Sunday trick won't work in* Symphony *Releases 1 and 1.01 because they return only the integer portion of the remainder.*

HIDE NOTES WITH THE BACKSLASH KEY AND A SPACE

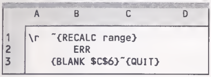
You can hide notes within a worksheet by preceding the cell contents with a backslash followed by a space. To see how this technique works, insert a column to the right of the cell you wish to annotate and set the column width to 1. Type a backslash, press the Spacebar, type the note, and press Return. The note will not appear on the screen display or printout, but you can read the note by placing the cell pointer on the appropriate cell. If the note is longer than *1-2-3* or *Symphony* can display in the control panel, press the EDIT key to view the entire note.

Tom Miller
MicroProse Computing
Phoenix, Ariz.

In 1-2-3 *Release 3 you can add a comment to a value, formula, or range name. To annotate a value or formula, type the value or formula, type a semicolon, then type the explanatory note. For example,* 69000;Northeast Sales *is an annotated value. When the cell pointer is on the cell containing an annotated value, the annotation appears in the control panel. The annotation doesn't appear in the cell itself unless you format the cell as text. To annotate a range name, use the Range Name Note command.*

CALCULATE A NAMED RANGE OR CELL WITH A MACRO

Here's a short macro that uses string formulas to recalculate any named range or specified cell. Use this macro when you don't want to press the CALC key to recalculate the entire worksheet, or when you don't want to move the cell pointer to a specific cell, press the EDIT key, and press Return.



```
        A       B           C           D
1    \r  ~{RECALC range}
2            ERR
3        {BLANK $C$6}~{QUIT}
```

Enter the macro in an out-of-the-way location in one of your worksheets. After you enter cells B2 and B3, cell B2 will evaluate to ERR (see the figure). This is because the formula attempts to recalculate itself, which results in a circular reference.

Assign the label in cell A1 as the name of the macro and assign the name *range* to range B1..B3: Place the cell pointer on cell A1, press slash (in *Symphony*, MENU), select Range Name Labels Right, and press Return. Then press slash (in *Symphony*, MENU), select Range Name Create, enter *range*, and specify range B1..B3.

To use the macro, move the cell pointer to a blank cell, enter a range name or cell address you wish to recalculate, then start the macro by holding down the MACRO key (Alt on most computers) and pressing R. Here's how it works:

~{RECALC range} recalculates the macro.

+"{RECALC "&@CELLPOINTER ("contents")&"}" enters the range name or cell address that you just typed into the control panel and recalculates the range or cell.

+"{BLANK "&@CELLPOINTER ("address")&"}~{QUIT}" erases the current cell and ends the macro.

Gary de la Rosa
Lotus Information Network Corp.
San Mateo, Calif.

This macro does not work in 1-2-3 *Release 1A.*

ABSOLUTE REFERENCES

I've found a way to copy a formula that has an absolute reference so that the cell appears to contain a formula with a relative reference. This technique is useful if you need to have absolute references to some cells but want to duplicate the model or formulas elsewhere in your worksheet.

For example, enter the value 10 in cell A1 and the value 5 in cell A2. In cell B1 enter the formula +$A$1. Cell B1 evaluates to 10. If you wish to copy the formula in cell B1 to cell B2 but want it to reference cell A2, you normally have to reenter the formula. Instead, use the File Xtract Formulas command to extract the contents of cell B1 to a temporary file, *temp*. Next, place the cell pointer on cell B2, select /File Combine Copy Entire-File (in *Symphony*, SERVICES File Combine Copy Entire-File Read Formulas), and enter *temp*. Now, cell B2 contains the formula +$A$2 and evaluates to 5.

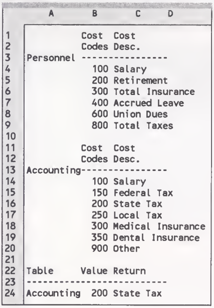
Be sure that the dependent-reference variable, cell A2 in the example above, does exist.

Gregory S. Olsby
Woodinville, Wash.

VARIABLE INPUT RANGE WITH @VLOOKUP FUNCTION

I sometimes need to use more than a two-dimensional lookup table. Typically, this occurs when more than one department uses the same codes and each department assigns different descriptions to the same code.

I need a way to make the input-table portion of the @VLOOKUP function variable so that it can reference different department names. Fortunately, the @@ function works with ranges as well as with single cell contents, and it works when you embed it in an @VLOOKUP function. In the following example, use the Range Name Create command to name the range B4..C9 *personnel* and the range B14..C20 *accounting*. Cells A24 and B24 contain the input-table name and value, respectively, that I want to look up. The @VLOOKUP function in cell C24 contains a reference to the table name through the @@ function: @VLOOKUP(B24,@@(A24),1).



```
        A           B      C       D
1                 Cost  Cost
2                 Codes Desc.
3    Personnel ----------------
4                    100 Salary
5                    200 Retirement
6                    300 Total Insurance
7                    400 Accrued Leave
8                    600 Union Dues
9                    800 Total Taxes
10
11                Cost  Cost
12                Codes Desc.
13   Accounting----------------
14                   100 Salary
15                   150 Federal Tax
16                   200 State Tax
17                   250 Local Tax
18                   300 Medical Insurance
19                   350 Dental Insurance
20                   900 Other
21
22   Table        Value Return
23   -------------------------
24   Accounting  200 State Tax
```

The tables you work with may be different sizes and may contain different kinds of information.

Greg Glazner
Commercial Software Systems
Littleton, Colo.

1-2-3 *Release 1A doesn't have the @@ function.*

USING @DATEVALUE INSTEAD OF @DATE

I frequently need to enter dates related to financial transactions and to perform many calculations based on these dates. I find that using the @DATE function is a laborious task. Instead, I enter the dates as labels, using one of the predefined date formats of *1-2-3* Releases 2/2.01 and 2.2 or *Symphony*. For example, I enter in cell A2 *'02/01/89*, which is the date a loan was made, and I enter in cell B2 the date the loan is due, *'08/15/89*. Then I enter in cell C2 the following formula to find the number of days between the two dates:

@DATEVALUE(B2)
−@DATEVALUE(A2)

Robert T. Lin
Pan Pacific Plastics Mfg.
Hayward, Calif.

You don't have to type the leading zeros for the day and month. And if you enter a date that falls within the current year, you don't have to type the year. You can enter '2/1 in cell A2 and '8/15 in cell B2.

1-2-3 *Release 1A doesn't have the @DATEVALUE function.*

In 1-2-3 *Release 3 if you enter a date using a format that* 1-2-3 *recognizes, such as 2/1/89, the program automatically converts the entry to a date number.*

This material was prepared by Subhadra Mattai and the Technical Editors, with the help of the Lotus Product Support staff

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104	Corporate Software	13
—	Dow Jones & Company Inc.	35
111	Funk Software	37
107	Group 1 Software	17
110	HavenTree Software Limited	23
—	IBM Corporation	8, 54–55
113	Intel	71
105	Intex Solutions	111
119	The Lambda Group	11
—	Lotus Development Corporation	28–31, 42–43, 72
—	Microsoft Corporation	66–67
106	Pacific Data Products	27
115	Personics Corporation	49
121	Que Corporation	Cover 4
118	Reasonable Solutions	109
112	Sheng Labs Inc.	39
—	Software Publishing Corporation	24
116	Software Spectrum	83
101	Sony Corporation	Cover 2
108	STSC Inc.	19
120	Symantec Corporation	115
102	Toshiba America Inc.	2–3
—	Unisys Corporation	112–113
109	Zenith Data Systems	21

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NO.	TITLE	PAGE
1	IDEAS & TRENDS	9
2	@LOTUS	22
3	START HERE *1-2-3*: Database	25
4	1-2-3 MACROS How to Build a Versatile Toolbox	32
5	MACRO BASICS A Faster Way to Copy	38
6	@WORK *Symphony* Typing Tester	40
7	FEATURE A Macro Library Address List	44
8	FEATURE Population Forecasting	50
9	FEATURE Life Insurance Analyzer	57
10	FEATURE Computer Savvy in the B-Schools	60
11	FEATURE Where Did I Stash That Worksheet?	68
12	SPECIAL REPORT Basic Worksheet Math	74
13	SPECIAL REPORT An @Function Primer	76
14	SPECIAL REPORT Choose Formulas over Macros	81
15	SPECIAL REPORT Formulas in Boolean Shorthand	84
16	SPECIAL REPORT Fix That Formula	86
17	SPECIAL REPORT @Functions from Scratch	91
18	Q&A	94
19	GOOD IDEAS	100
20	REVIEW Ways to Make Friends with DOS	105
21	REVIEW Expanded Memory Without New Equipment	108
22	NEW PRODUCTS	114
23	ESSAY The Lotus Cross-Platform Strategy	120

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106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126
127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147
148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168
169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189
190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210

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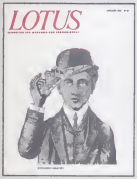

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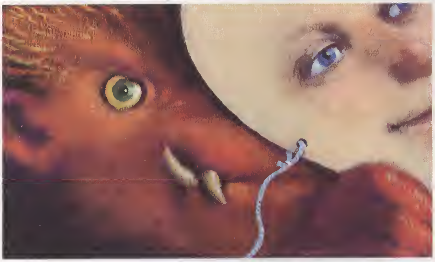
THREE WAYS TO MAKE FRIENDS WITH DOS

The Norton Commander 2.0, *XTreePro* 1.1, and the DOS 4.0 SHELL command

BY TOM CARLTON AND R. MARTIN TEMPLE



Why can't DOS be like other programs you use? Where are the menus and the on-line help? And why must you contend with command strings like *backup c:\123\ a:/s/m?*

DOS's facilities for managing files also leave a lot to be desired. Since a file name is limited to eight characters with a three-character extension, you often can't tell from its name what's in a file. Even if you know the name of the file you want to work with, there's no easy way to locate the subdirectory in which it resides. And if you need to copy or delete several files, DOS can really frustrate you. If the files are similarly named, you can use DOS's wild-card feature to copy or delete them with one command. But if they're not similarly named, you have to copy or delete them one at a time.

The Norton Commander, XTreePro, and the SHELL command in DOS 4.0 each solve some of those problems. These programs are often called DOS shells because they "cover up" DOS with a different user interface—one that's easier to learn and use.

DOS shells also share some features with programs such as *Lotus Magellan* (Lotus Development Corp., 617-577-8500) and *ViewLink* (Travelling Software, 206-483-8088), but the shells serve a different purpose. *Magellan* and *ViewLink* are designed to help you manage files based on their content, whereas DOS shells make it easier for you to manage files by name.

If you use *1-2-3*, you'll appreciate *The Norton Commander* because it lets you peek at *1-2-3* worksheets without loading *1-2-3*. If you're in doubt about the contents of a worksheet file, you can just look at it. *The Norton Commander* also lets you switch easily between its menus and the DOS prompt, which is important when you need to use a DOS command that isn't included in *The Norton Commander*'s menus, such as FORMAT.

If you often need to perform the same operations on a host of files scattered across different subdirectories, you'll prefer *XTreePro*. This program makes it easy to find, copy, move, or back up files stored in a single directory, over an entire disk drive, or across all the disk drives connected to your computer. Unfortunately, it makes it just as easy to delete all your files if you're not careful.

The DOS 4.0 SHELL command includes more DOS commands than do either of the other two programs. Although its menus are more cumbersome than those of the other two shell programs, it can still make your work with DOS much easier. Of course, if you've already purchased DOS 4.0, the SHELL command is the most economical alternative—it's part of that program.

DOS AT YOUR COMMAND

DOS shells tame DOS a little by making it easier to use the most common DOS commands.

Choose commands from menus. All three DOS shells let you use menus or function keys to execute commonly used DOS commands: COPY, DELETE (or ERASE), RENAME, MKDIR (Make Directory), CD (Change Directory), and RMDIR (Remove Directory). Each also provides a Move command, which lets you move one or several files from one directory to another, without leaving the original behind.

Unlike the menus in the other two programs, DOS 4.0's menus also let you use the commands BACKUP, RESTORE, FORMAT, DISKCOPY, and DISKCOMP (Disk Compare). But even though DOS 4.0's menus offer extra functionality, you may find them somewhat tedious compared with those of the other two shells. To choose a command from DOS 4.0's menus, you have to press a function key and then select at least two more menu items. *The Norton Commander* and *XTreePro* let you choose commands with a single keystroke.

Collective action. Each shell pro-

Tom Carlton is a manager of corporate business analysis, and R. Martin Temple is a consultant, at a midwestern Fortune 500 firm.

KEVIN HAWKES

gram lets you mark files and then copy, delete, move, or rename all marked files at once. This capability comes in handy if you create disks for distribution or if you have to make space on your disk by removing certain types of files, such as backup files.

XTreePro does the most to help you find and mark these widespread files. You can sort, alphabetically by file extension, all the files on any disk connected to your computer. So if you have two hard disks, you could sort at once the files stored on both. The program creates the list quickly—it sorted about 3,000 files on a Compaq Deskpro 386 in a few seconds. If you don't need to see the names of files before you mark them, you can use commands that let you mark all files matching a certain criterion in any combination of drives or directories.

DOS 4.0 can act on as many files as you want, but you have to mark the files one directory at a time. *The Norton Commander* restricts both marking and action to one directory at a time. These methods seem undesirable compared with *XTreePro*'s, but *XTreePro*'s power can get you into trouble. It's easy to accidentally delete all the files in all drives connected to your computer. The other programs' restrictions and their two levels of confirmation before every delete command make this disaster less likely.

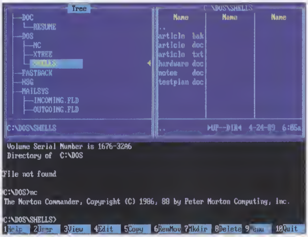
Picture your directories. At all times, each shell program provides a directory-tree diagram that depicts the location of files in your current directory, or lists the files in your current directory, or provides both the diagram and the list. If you want to move to a new directory, highlight the name of the directory on the tree diagram and press Return. If you switch directories often, a tree diagram can save you a lot of keystrokes.

DOS 4.0 can display trees and lists for two directories at once. That's helpful when you copy or move a file from one directory to the next. Because you can see both the source and destination directories, you're less likely to overwrite a file that has the same name as the destination file.

Returning to DOS. *The Norton Commander* lets you use its menus and the DOS prompt at the same time. If you enter a command at the DOS prompt and need to specify a file name as part of that command, you can pop up a directory listing and highlight the name of the file you want to work with. *The Norton Commander* will enter the file name into your command.

All three shells unload part of themselves from memory when you switch to the DOS prompt, to leave as much room as possible in which to run applications. DOS 4.0 and *The Norton Commander* shrink to 3K and 10K–15K, respectively, but *XTreePro* leaves 59K of itself in RAM. This could limit, for example, the size of a *1-2-3* file you're working with, or it could determine whether or not you can use an add-in program.

Help. *XTreePro*'s on-line help is the best of the lot. In addition to several pages of information, the program displays all commands at the bottom of the screen. Although DOS 4.0's help is context-sensitive, it is brief—just enough to jog your memory if you forget a detail



The Norton Commander lets you display a tree diagram and a file list in the top half of the screen and the DOS prompt in the bottom half. You can select DOS commands through its menus or type them at the DOS prompt.

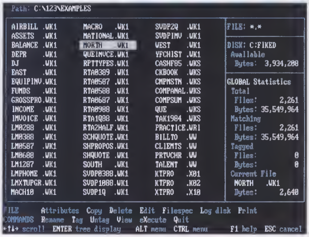
```
                  Tree                          C:\DOS\SHELLS
 ──DOC                                 Name        Name        Name
   └──RESUME                         ..
 ──DOS                               article  bak
   ├──NC                             article  doc
   ├──XTREE                          article  txt
   └──SHELLS                         hardware doc
 ──FASTBACK                          notes    doc
 ──MSG                               testplan doc
 ──MAILSYS
   ├──INCOMING.FLD
   └──OUTGOING.FLD

C:\DOS\SHELLS                        ..        ►UP--DIR◄  4-24-89  6:05a
 Volume Serial Number is 1676-32A6
 Directory of  C:\DOS

File not found

C:\DOS>nc
The Norton Commander, Copyright (C) 1986, 88 by Peter Norton Computing, Inc.

C:\DOS\SHELLS>
1Help  2User  3View  4Edit  5Copy  6RenMov 7Mkdir 8Delete 9 enu  10Quit
```

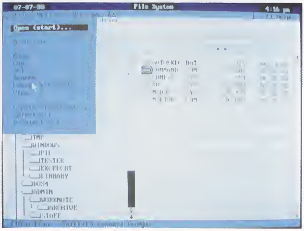


XTreePro lets you sort all the files in all your disk drives alphabetically by file extension. The tree diagram is omitted during a sort, but the path indicator at the top of the screen gives the highlighted file's location.

```
 Path: C:\123\EXAMPLES

 AIRBILL .WK1     MACRO   .WK1     SVDP2Q  .WK1     FILE: *.*
 ASSETS  .WK1     MATIONAL.WK1     SVDPIMV .WK1
 BALANCE .WK1     NORTH    WK1     WEST    .WK1     DISK: C:FIXED
 DEPR    .WK1     QUEINVCE.WK1     YFCHIST .WK1      Available
 DJ      .WK1     RPTTYPES.WK1     CASHF85 .WKS       Bytes:  3,934,208
 EAST    .WK1     RTA0389 .WK1     CKBOOK  .WKS
 EQUIPINV.WK1     RTA0587 .WK1     CMPMSTN .WKS     GLOBAL Statistics
 FUNDS   .WK1     RTA0588 .WK1     COMPANAL.WKS      Total
 GROSSPRO.WK1     RTA0687 .WK1     COMPSUM .WKS       Files:       2,261
 INCOME  .WK1     RTA0988 .WK1     QUE     .WKS       Bytes: 35,549,964
 INVOICE .WK1     RTA1Q88 .WK1     TAK1984 .WKS      Matching
 LM0288  .WK1     RTA2HALF.WK1     PRACTICE.WR1       Files:       2,261
 LM0388  .WK1     SCHQUOTE.WK1     BILLTO  .WW        Bytes: 35,549,964
 LM0587  .WK1     SHPROPOS.WK1     CLIENTS .WW       Tagged
 LM0688  .WK1     SHQUOTE .WK1     PRTVCHR .WW        Files:           0
 LM1287  .WK1     SOUTH   .WK1     TALENT  .WW        Bytes:           0
 LMPHOME .WK1     SVDP0388.WK1     KTPRO   .X01      Current File
 LMXTUPGR.WK1     SVDP1088.WK1     KTPRO   .X02       NORTH   .WK1
 MACH10  .WK1     SVDP1Q  .WK1     XTPRO   .X10       Bytes:       2,640

FILE      Attributes  Copy  Delete  Edit  Filespec  Log disk  Print
COMMANDS  Rename  Tag  Untag  View  eXecute  Quit
←↑↓→ scroll  ENTER tree display    ALT menu  CTRL menu      F1 help  ESC cancel
```



If you use a mouse, you can move quickly through the pull-down menus in DOS 4.0's shell. Otherwise, you may get bogged down in extra keystrokes.

PRESENTATION MANAGER VS. THE DOS SHELLS

Presentation Manager, which comes with OS/2 Version 1.1, purports to be the next generation of user interface for the PC. How does it compare with the DOS shells in functionality and ease of use? Very well, it turns out.

Presentation Manager (PM) basically provides the same functions as the DOS shell programs in this review and is about as easy to use. The only major function of the DOS shells that PM does not have is the ability to view ASCII, *1-2-3*, and *dBase* files without going into a text editor or loading the corresponding application.

PM is menu-driven, and it has extensive on-line help. You can use it with a keyboard, but it's designed for use with a mouse. You can perform the same directory and file functions as you can using the DOS shells. You can set up PM to launch your applications from a menu or from a file.

One advantage of PM over the DOS shells is PM's ability to have many directory windows open at the same time and to work with some or all of them at once. In the DOS shells, you can open only one or two directory windows at the same time. You'll appreciate the multiple-directory capabilities of PM when you work with files in several directories—for example, when you consolidate selected files from four directories into one or when you eliminate duplicate files from seven different directories. In the DOS shells, you have to work with one or two directories at a time or use the global file capabilities of *XTreePro*.

Note, however, that OS/2 requires an 80286- or 80386-based computer and 2 megabytes of memory. If you want to run DOS programs in OS/2's DOS-compatibility box, you'll need at least 2.5 megabytes of memory. You can run only one DOS program at a time in the DOS-compatibility box. Some DOS programs don't run in the compatibility box. For those that do, the available RAM is 76K smaller than it is under DOS 3.3. The reduced DOS memory can be a limitation with large *1-2-3* programs or other DOS applications that require a 640K machine to run. For these reasons, OS/2 makes sense only if you need to run OS/2 applications.

—T. C.

about the command you want to use. *The Norton Commander*'s few pages of help are sparse also, but they still save you the inconvenience of having to refer to the cryptic DOS manual.

SPECIAL FEATURES

The DOS shells have some special features that go beyond the DOS commands. Here's how they compare.

Find files fast. Of all the benefits a DOS shell can deliver, the one you'll appreciate most is the ability to find the files you need.

All three shell programs let you view some portion of the contents of some kinds of files, without starting the application in which you created the file. You can take a quick look at the contents of a file instead of trying to glean from the file name what the file contains. This is especially useful if you have to find one version of a commonly used template or if you have to make space on your hard disk by removing files that you don't need.

Each shell lets you view files from some of your applications in ASCII text format. In most cases, this ASCII file doesn't look exactly as it did when you created it with your application, but you'll be able to determine its contents easily. *The Norton Commander*'s file-viewing feature goes one step further. With it you can see a *1-2-3* or *dBase* file exactly as it appears when you use either of those programs. You can move your cursor from cell to cell, as you can when you work with your application. When you move your cursor to a cell containing a formula, you will see the value rather than the formula, and the word *formula* appears in the control panel.

You can't view *1-2-3* or *dBase* files with *XTreePro*. When you view a *1-2-3* or *dBase* file with DOS 4.0, you see only the labels and not the numbers, and the labels are not arranged in row-and-column format. Your cursor moves from character to character, so it takes longer to scroll through a large file.

The Norton Commander also lets you quickly search for files by name. You simply press the Alt key and begin typing the name of the file. With each character you enter, *The Norton Commander* highlights all files containing that initial sequence of characters until you arrive at the single file you want. The feature works the same way to help you find a subdirectory.

Launch applications. Once you find the file you're looking for, *The Norton Commander* and DOS 4.0 let you begin working on it immediately. Both programs let you design a small macro that will start the application you used to create a highlighted file and then retrieve that file. DOS 4.0 lets you create such macros for up to 20 applications; *The Norton Commander* lets you do the same for an unlimited number of applications. *XTreePro* offers no such capability.

Both DOS 4.0 and *The Norton Commander* also let you create menus from which you can load applications. Again, *XTreePro* does not. ■

IN BRIEF

The Norton Commander Version 2.0. Peter Norton Computing, 100 Wilshire Blvd., Suite 186, Santa Monica, CA 90401-1104; 213-319-2000. Runs on the IBM PC, PC XT, PC AT, PS/2, and compatible computers. Requires DOS 2.1 or higher and 140K of RAM. Released 7/88. $89. 5¼- and 3½-inch disks included. Defective-disk warranty for an unlimited time.

XTreePro Version 1.1. XTree Co., a division of Executive Systems, 4330 Santa Fe Rd., San Luis Obispo, CA 93401; 805-541-0604. Runs on the IBM PC, PC XT, PC AT, PS/2, and compatible computers. Requires DOS 2.1 or higher and 256K of RAM. Released 11/87. $129. 5¼- and 3½-inch disks included. 90-day, defective-disk warranty.

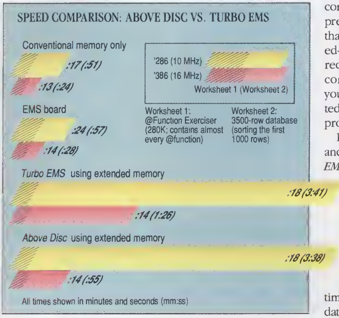
DOS 4.0. IBM (dial 800-IBM-2468 for the nearest IBM marketing representative or dealer). Runs on the IBM PC, PC XT, PC AT, and PS/2. Requires approximately 62K of RAM; 256K to use the DOS shell. Released 7/88. $150. Available on 5¼- and 3½-inch disks. 90-day warranty on media; 90-day warranty on program defects.

OS/2 Version 1.1, Standard Edition. IBM (dial 800-IBM-2468 for the nearest IBM marketing representative or dealer). Also available from Compaq, Zenith, and NCR Corp. for their computers. Available on 5¼- and 3½-inch disks. Runs on the IBM PC AT and PS/2 models with an 80286 processor running at least 10 MHz or with an 80386 processor. Presentation Manager requires a CGA, EGA, or VGA display. Released 10/88. For price information, contact your dealer. 90-day warranty on media and program defects.

EXPANDED MEMORY WITHOUT NEW EQUIPMENT

Above Disc versus *Turbo EMS*

BY BILL LAWRENCE



CHARTS BY DAVE HANNUM

Suppose your computer has 640K of RAM and still runs out of memory before you finish building a worksheet. One way to solve this problem is to install an expanded-memory board. Such a board lets you work with more data than can fit into DOS's 640K limit.

But that's not always an ideal solution. These boards are expensive. For example, an Above Board (Intel Corp., 800-538-3373, in Oreg. 503-629-7369) that contains 2 megabytes of expanded memory costs as much as $1,445. Also, with the memory on such boards configured as expanded memory, the boards may not work with all the software that you buy. Although *1-2-3* Releases 2/2.01 and 2.2 use expanded memory, a growing number of programs, including *1-2-3* Release 3 and all OS/2 applications, use extended memory instead (see diagram on page 110). To accommodate both types of programs, you must either reconfigure your memory board, which requires you to "reboot," or restart, your computer, or you must install a separate memory board for each type of memory, which is expensive.

If you have extended memory now or plan to buy it, *Above Disc* ($99.95) or *Turbo EMS* ($295) can also give you expanded memory with a mere command. These programs cause extended memory to emulate expanded memory whenever you need it. For example, you can use your extended memory with a program such as *Professional Oracle* or *Paradox 386* and then, without rebooting, switch that memory to expanded memory when you want to use *1-2-3* Release 2.01.

Both programs also let you use free disk space as expanded memory. However, this approach slows down spreadsheet recalculation so much that you should use it only when you absolutely must. It is by no means efficient for daily operations.

If you need to switch only extended memory to expanded memory, you can get identical results with either program. But if you must use your hard disk as expanded memory, the *Turbo EMS* program is the better choice. Although worksheets will slow down dramatically no matter which program you use in this way, in our tests they ran anywhere from 9% to 36% faster with *Turbo EMS* than with *Above Disc*.

Turbo EMS also lets you specify and switch among several expanded-memory configurations, which you'll appreciate if you use programs that require different expanded-memory setups. *Above Disc* requires you to change its sole configuration file whenever you need a new setup. That's a tedious process if you switch programs often.

If you have both expanded and extended memory, *Turbo EMS* will make the most of what you have. Unlike its competitor, this program lets you combine extended memory, expanded memory, and disk space for use as expanded memory. This is a lifesaving option for those times when your worksheet or database occupies even more memory than you have on any single memory board. In these cases, the program automatically uses your memory boards first, moving to the slower disk only when necessary. Also, you can store most of *Turbo EMS* in your expanded memory, leaving more room in conventional memory for your applications.

If you have an 80386-based computer with extended memory, *Above Disc* is a better choice. On such a system, *Above Disc* runs up to one-third faster than *Turbo EMS* and leaves more room in conventional memory by storing itself in extended memory.

COMPATIBILITY

Both of these programs can also hamper you in a few ways. Both programs are slower than authentic expanded memory. Unless you have the above-mentioned equipment, both programs take up about 80K of conventional memory, which you may not be able to afford if you use other pop-up programs that use

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Bill Lawrence is a network engineer based in southern California and is a frequent contributor to LOTUS.

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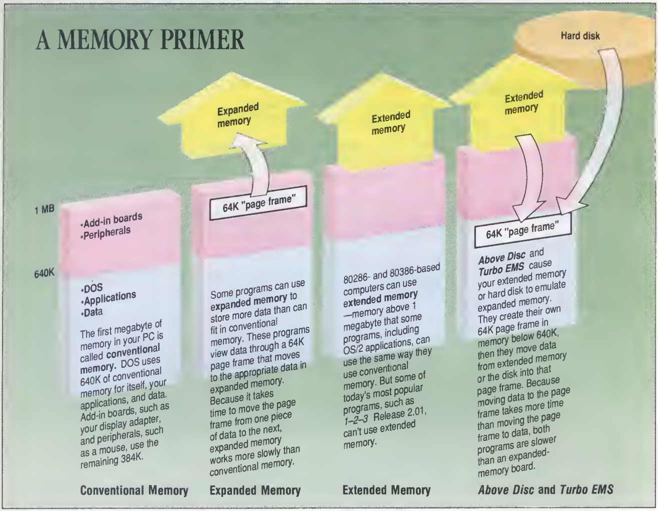

A MEMORY PRIMER

The first megabyte of memory in your PC is called **conventional memory.** DOS uses 640K of conventional memory for itself, your applications, and data. Add-in boards, such as your display adapter, and peripherals, such as a mouse, use the remaining 384K.

Some programs can use **expanded memory** to store more data than can fit in conventional memory. These programs view data through a 64K page frame that moves to the appropriate data in expanded memory. Because it takes time to move the page frame from one piece of data to the next, expanded memory works more slowly than conventional memory.

80286- and 80386-based computers can use **extended memory** —memory above 1 megabyte that some programs, including OS/2 applications, can use the same way they use conventional memory. But some of today's most popular programs, such as *1-2-3* Release 2.01, can't use extended memory.

Above Disc and ***Turbo EMS*** cause your extended memory or hard disk to emulate expanded memory. They create their own 64K page frame in memory below 640K, then they move data from extended memory or the disk into that page frame. Because moving data to the page frame takes more time than moving the page frame to data, both programs are slower than an expanded-memory board.

Conventional Memory **Expanded Memory** **Extended Memory** ***Above Disc* and *Turbo EMS***

How *Above Disc* and *Turbo EMS* emulate expanded memory

conventional memory. Finally, during my tests both programs proved incompatible with several programs that normally work with expanded memory.

Above Disc and *Turbo EMS* work as advertised with *1-2-3* and *SideKick Plus*. However, when they were installed according to the instructions in their respective manuals, neither *Above Disc* nor *Turbo EMS* worked with the network version of *1-2-3*. A technical-support representative for *Turbo EMS* talked me through an undocumented fix that solved this problem. No such fix was available for *Above Disc*.

Above Disc's manual states that the program will not work with *Desqview, Javelin*, or *Lotus Hal*. *Turbo EMS*'s manual claims that the program will work with *Desqview*, but in my tests my computer crashed after only a few minutes of swapping among *1-2-3*, DOS, and *WordPerfect* Version 4.1. The computer had worked reliably for some time, using these same programs before I installed *Turbo EMS*.

Both products worked with *Paradox* Version 2.0 after I used them to switch extended memory to expanded memory, but neither would work with *Paradox* 2.0 when set to use disk space as expanded memory. I could not make either product work with the network version of *Paradox* Version 3.0. *Above Disc*'s and *Turbo EMS*'s publishers each told me that their product won't work with either the network or the single-user version of *Paradox* 3.0.

NETWORK PROBLEMS

Each product's inability to work with the network software is frustrating because, in theory, you should be able to use either product to solve a network-related problem. If your PC is connected to a network—or if you use a peripheral such as a scanner or fax board—you may not be able to use an expanded-memory board. The reason for this is that many network cards and a few peripherals use some of the same memory above 640K that an expanded-memory board uses. If, after you install a network card, you don't have 64K of contiguous memory remaining for your expanded-memory board, the board won't work. But because *Above Disc* and *Turbo EMS* use the memory below 640K, you should be able to use either product with a network or with as many peripherals as you are able to install.

Consider, too, that by using 80K and 74K, respectively, *Above Disc* and *Turbo EMS* somewhat reduce the amount of expanded memory that would otherwise be available. That's because every piece of data stored in expanded memory still requires a small amount of conventional memory. The less conventional memory available, the less data your program can store in expanded memory, even though you may have lots of expanded memory free. If you use *Above Disc* or *Turbo EMS* with a pop-up application, such as *SideKick Plus* or *Lotus Express*, you run a greater risk of running out of conventional memory.

SPECIAL OPTIONS

As mentioned earlier, both programs offer a solution to this problem, provided you have the proper equipment. If you have an expanded-memory board, you can use it to store all but 9K of *Turbo EMS*. If you have an 80386-based computer with extended memory, *Above Disc* will occupy just 14K of conventional memory and store its remaining 66K in extended memory. *Above Disc*'s manual, however, does not document this feature clearly. I got it to work, but I had to call a technical-support representative for help.

But if you have an 80286-based computer equipped with extended memory only, *Turbo EMS* and *Above Disc* will cost you 74K and 80K, respectively, of conventional memory and, consequently, will also cost some amount of expanded memory. The more expanded memory you need on this kind of system, the better it is to purchase an expanded-memory board instead of *Above Disc* or *Turbo EMS*. Note that *Above Disc*'s publisher states that the latest version of the program uses only 2K of memory on an 80286-based computer equipped with extended memory. However, the publisher did not provide this release at the time of the review.

Using your disk as a stand-in for expanded memory is like using a bicycle as a stand-in for a jet airplane. When I used *Turbo EMS* in this way, the worksheets I tested recalculated as much as 67 times slower than they did with real expanded memory. When I used *Above Disc*, they ran as much as 107 times slower.

But this feature is not a totally useless one. If you have to, you can use your hard disk as expanded memory to build a large database worksheet. Using either *Above Disc* or *Turbo EMS*, I was able to build a mailing database of 8,000 rows in *1-2-3*. It took only slightly longer to scroll through this database than to scroll through a similar database in authentic expanded memory.

However, that's about the limit of this feature's practicality. Using *Turbo EMS*, it took a little less than one hour to sort the first 1,000 rows in a 3,500-row database. Using *Above Disc*, it took more than one and a half hours. Using an expanded-memory board, the same operation took less than a minute. ■

IN BRIEF

Above Disc Version 2.0B. Teleware West, 3 Hutton Center, Suite 950, Santa Ana, CA 92707; 800-344-0116, in Calif. 714-545-1181. Runs on the IBM PC XT, PC AT, PS/2, and compatible computers. Requires DOS 3.0 or higher and 256K of RAM. Released 12/88. $99.95. 90-day warranty against defective disks. (Version 3.0 was released 6/89.)

Turbo EMS Version 4.2. Lantana Technology, 4393 Viewridge Ave., Suite A, San Diego, CA 92123; 800-544-2688. Runs on the IBM PC XT, PC AT, PS/2, and compatible computers. Requires DOS 2.0 or higher and 256K of RAM. Released 4/89. $295. 90-day warranty. (At press time, a new version that contains a second diver for '386 machines was scheduled for release this month.)

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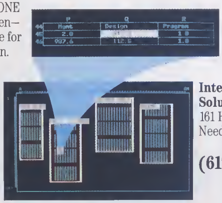

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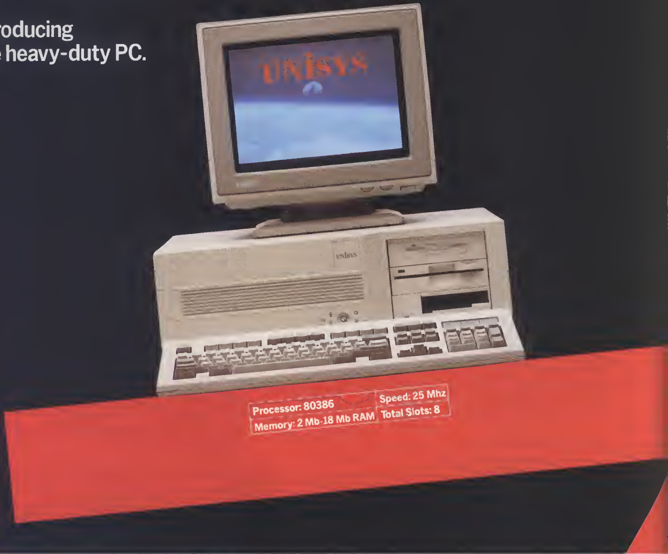

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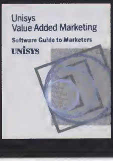


UNISYS

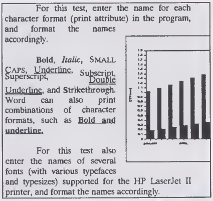
Microsoft Word 5.0 Jumps Ahead of WordPerfect—for Now

In each of the last several releases of *Word* and *WordPerfect*, each program's performance has leapfrogged the other's. With the release of *Word* Version 5.0, Microsoft's word processor moves in front once again. It matches all the important features in *WordPerfect* Version 5.0 (WordPerfect Corp., 801-225-5000) and has a few you won't find in *WordPerfect*.

The most dramatic addition to *Word* 5.0 is the integration of text and graphics. Earlier versions could print graphics, but could not do such things as include graphics in multicolumn documents. The new version will print graphics as part of a single-column layout, newspaper-style layout, or side-by-side multicolumn layout. You can place the graphic anywhere on the page—in a margin, within a column, or across columns. It lets you select the size of the graphic and automatically wraps text around a graphic that intrudes into a column.

Greater access to graphics

Word 5.0 can read Lotus PIC files. It can also read several other graphics-file formats, including PCX (used in *PC Paintbrush*), HPGL, TIFF (used with many scanners), and Encapsulated PostScript. For those file formats it can't read directly, *Word* comes with a utility that will capture any screen image and save it to disk in a format that *Word* can read. From *Microsoft Windows*–based programs, *Word* lets you import only bit-mapped graphics through the *Windows* Clipboard.

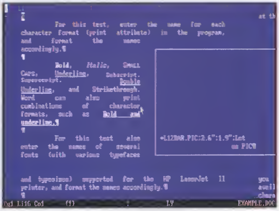


For this test, enter the name for each character format (print attribute) in the program, and format the names accordingly.

Bold, *Italic*, SMALL CAPS, Underline, Subscript, Superscript, Double Underline, and ~~Strikethrough~~. Word can also print combinations of character formats, such as **Bold and underline.**

For this test also enter the names of several fonts (with various typefaces and typesizes) supported for the HP LaserJet II printer, and format the names accordingly.

***Microsoft Word* 5.0 automatically wraps text around embedded graphics.**



For this test, enter the name for each character format (print attribute) in the program, and format the names accordingly.¶

¶

Bold, *Italic*, Small Caps, Underline, Subscript. Superscript. Double Underline, and Strikethrough. Word can also print combinations of character formats, such as Bold and underline.¶

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For this test also enter the names of several fonts (with various typefaces

•L12BAR.PIC:2.6":1.9":Lot us PIC¶

and typesizes) supported for the HP LaserJet II printer, and format the names accordingly.¶

¶

This is the same document as it appears in *Word*'s editing screen, using the program's graphics mode and an IBM Enhanced Graphics Adapter.

The same features that let you position graphics also yield greater flexibility for text layout. For example, you can position anywhere on a page any text that is enclosed within a box, and the program will automatically wrap body text around it. You can easily begin a paragraph with an enlarged capital letter, known as a drop cap, and the text automatically flows around it.

A new feature lets you preview both text and graphics before printing. This is particularly helpful for checking the final layout of a document because it saves you the time required to print the document. And the more complex the layout, the more time you'll save. It took just 3.5 seconds to view a page of text on a 12-MHz IBM PC AT–compatible computer equipped with an IBM Enhanced Graphics Adapter.

The program can show multicolumn layouts while you edit, using dotted outlines to indicate areas where graphics will be inserted when you print. Even without showing such details as font size, this feature makes it easier to modify a layout. When you choose to display the layout, *Word* slows down noticeably as you update a screen or move through a document.

Word 5.0 can automatically save files and paginate—two capabilities you can turn on or off. The program lets you set the automatic-save feature to save at any time interval, and you can have the program request confirmation before each save. Autopagination continuously determines the location of page breaks, eliminating the chore of manual repagination.

New macro facility

Word 5.0 retains, as well as improves upon, a host of features of earlier versions. The program continues to be the only leading word processor that works

ALSO IN THIS ISSUE

BUSINESS, FINANCE 116
UTILITIES 116
OTHER SOFTWARE 117
SERVICES. 117
HARDWARE 117
TRAINING, REFERENCE. 118
UPGRADES 119
BOOKS. 119

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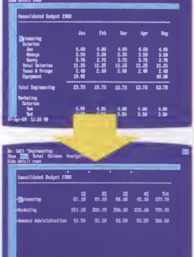

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with a mouse, that has a built-in collapsible outliner, and that can link documents to *1-2-3, Microsoft Multiplan*, or *Microsoft Excel* spreadsheets. Its macro facility, already among the best in a word processor, has new commands. It retains its logical menu structure, with the new commands added just where you would expect to find them. If you already use *Word*, you'll have no trouble moving to version 5.0., nor will you find the upgrade cost a deterrent. Even if you currently use another word processor, *Word* 5.0 is well worth a look.

—Marc Davidson

Microsoft Word Version 5.0. Microsoft Corp., 16011 Northeast 36th Way, Redmond, WA 98073-9717; 206-882-8080. Requires an IBM PC, PS/2, or compatible computer with 384K of RAM and DOS 2.0 or higher or OS/2. Manufacturer recommends a hard disk. Runs with a Microsoft Mouse, IBM PS/2 mouse, or compatible mouse. Released 5/89. $450; free upgrade from previous version if previous version was purchased after 10/1/88; $75 for upgrade from all other versions.

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All require *1-2-3* Release 2/2.01 or any release of *Symphony*. Manufacturer recommends 512K of RAM. $195 each for *Financial* and *Stats*; $495 each for *Bond, Options*, and *Mbs*; $1,495 for all five. From Tech Hackers, 515 Broadway, New York, NY 10012; 212-941-7330.

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Personal Investor's Add-in to Calculate Options

The Options @vantage, Personal Version, is a *1-2-3* add-in that provides basic support for options pricing and sensitivity analysis. @Functions let you figure the put and call prices on stock, as well as the implied volatility of a series of put or call options. The program lets you calculate the exact expiration date of an option, figure the net present value of a dividend, calculate the cumulative normal distribution, convert decimals to fractions and vice versa, and convert numbers to labels. Preconfigured worksheets let you analyze a covered call, portfolio risks, and the implied volatility of your stock and index options. One worksheet lets you graph an option.

Requires *1-2-3* Release 2/2.01 or 2.2 and uses 13K of RAM. $65, from Financial Functions, 400 South La Salle St., Box 777, Chicago, IL 60605; 800-346-4678.

CIRCLE 3 ON READER SERVICE CARD

UTILITIES

Print up to 20 1-2-3 Graphs on One Page, Add New Types

Graph/Array was designed for managers who need to analyze data in graph form. Using *1-2-3* worksheet data, it lets you define and print up to 20 of the same kind or 20 different kinds of graphs on one page. It offers some graphs not offered by *1-2-3*. These include four kinds of mixed bar and line charts, a negative bar chart, two horizontal bar charts, and three charts that incorporate two scales in one graph. You can combine yearly and monthly data in one graph. All graphs print in one size, approximately 1 inch by 1½ inches, on either a dot-matrix or a laser printer. To use the program, you save to a PRN file the *1-2-3* data you want graphed, then exit *1-2-3*. In *Graph/Array* you define the layout, then print the graphs.

Requires *1-2-3* Release 2/2.01, 2.2, or 3. Uses 32K of RAM when running with *1-2-3* and 230K of RAM when running alone. Through September 30, $95 for version for dot-matrix printers, $145 for laser-printer version; afterwards, $145 and $195, respectively. From Intex Solutions, 161 Highland Ave., Needham, MA 02194; 617-449-6222.

CIRCLE 4 ON READER SERVICE CARD

ASCII/1-2-3 File Conversion

Con-F File Conversion Utility lets you merge downloaded mainframe data into worksheets, create worksheet files using ASCII-file data, and change the layout of existing ASCII and worksheet files. You can select multiple import criteria and import the data into any worksheet location. The program will not overwrite existing data.

Requires *1-2-3* Release 2/2.01 and 512K of RAM. $99.95, from PC Systems, 8 Lee Park Ave., Wilkes-Barre, PA 18702; 717-822-8920.

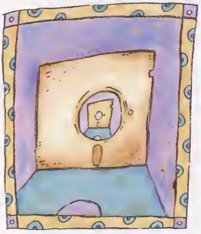
CIRCLE 5 ON READER SERVICE CARD

Laser-Printer Luster for Dot-Matrix Printers

Near Laser NicePrint makes dot-matrix printer output look more like laser-printer output. The pop-up software mimics a *PostScript* laser printer's type sizes, characters, styles, and special effects, such as outline, shadow, and foreign-language accent marks. It can also proportionally space and automatically justify your text. The software runs with all releases of *1-2-3* (except Release 3), *Symphony, dBase*, and *Microsoft Word, WordPerfect*, and *WordStar*. The program is compatible with most dot-matrix printers, including those from IBM, Epson, Toshiba, and NEC.

Runs on the IBM PC, PS/2, and compatible computers and uses 90K to 130K of RAM, depending on the printer model. $99, from Spies Laboratories, 4040 Spencer St., Bldg Q, Torrance, CA 90503; 800-255-9433, in Calif. 800-992-9433.

CIRCLE 6 ON READER SERVICE CARD



OTHER SOFTWARE

U.S. Economic-Growth Data and Simulations in 1-2-3

Model of U.S. Economic Growth, designed for economists and corporate forecasters, provides a model for long-term growth analyses in *1-2-3*. You can change the projection assumptions or modify the model's variables to include specific industries or companies. The model includes 100 endogenous, or dependent, variables and 93 exogenous, or independent, variables. The program contains the model's equations, an historical simulation of the model, a projection for the years 1988 to 2010, and instructions for building applications.

Requires *1-2-3* Release 2.01 and 640K of RAM. $295, from NPA Data Services, 1616 P St. NW, Suite 400, Washington, D.C. 20036; 202-265-7685.

CIRCLE 7 ON READER SERVICE CARD

Agenda Databases for Builders and Technical Support

The Builder's Organizer is a *Lotus Agenda* database that you can use to monitor information related to the construction of a building of any size. It helps you track agreements and contracts with clients, architects, subcontractors, and employees. You can access all field notes from blueprints and other specifications. The software lets you track overall and day-to-day schedules of projects, as well as questions and pending decisions. A separate database, *Info Center Hotline*, helps you manage any technical-support or complaint-handling operation. The software lets you keep track of questions and answers and provides a report of problems, listed by frequency. Both programs let you keep a file of names, addresses, and phone numbers.

Requires *Lotus Agenda*. $199.95 for *The Builder's Organizer*; $69.95 for *Info Center Hotline*. From Easy Software. P.O. Box 16, Planetarium Station, New York, NY 10024; 212-580-8761.

CIRCLE 8 ON READER SERVICE CARD

Prewritten Business and Sales Letters Follow Books' Ideas

The Instant Business Letters System provides 281 letters on disk for common business situations. The letters are drawn from the included book, *Complete Book of Model Business Letters*, by Martha Cresci, from Prentice Hall. *The Instant Sales Letters System* provides 200 letters on disk for common sales situations. These letters come from the included books, *Letters That Sell*, by Edward W. Werz, and *Words That Sell*, by Richard Bayan, both published by Contemporary Books. Each package includes a database to store names and addresses that you can merge into letters. The programs pop up over most word-processing software.

Both run on the IBM PC, PS/2, and compatible computers and use 40K of RAM. $89 each, from LightningWord Corp., 1601 Civic Center Dr., Suite 206, Santa Clara, CA 95050; 800-426-4381, in Calif. 408-241-1990.

CIRCLE 9 ON READER SERVICE CARD

SERVICES

Indexes to LOTUS and Data Based Advisor on Disk

Index to LOTUS Magazine Articles and *Index to Data Based Advisor Articles* cover each magazine from January 1988 forward. You can use keywords to search for a product name, author, subject, or the periodical's volume number. The index is updated semiannually, following the publication of the June and December issues of each magazine.

Runs on the IBM PC, PS/2, and compatible computers with 512K of RAM and a hard disk. For either magazine, $10 for current year's index, $5 for past year's, $17 for combined 1988–90 indexes to first-time subscribers; $2 surcharge for 3½-inch disk. From The Info Group, 1905 Pebblebrook, O'Fallon, MO 63366; 314-281-4613.

CIRCLE 10 ON READER SERVICE CARD

Telephone-Support Alternative for 1-2-3 and Symphony

@Once Help-Line provides technical support by telephone for all releases of *1-2-3*, including 2.2 and 3, and *Symphony*. The charge is $2 per minute, and the company says calls average 10 to 20 minutes. A discount is available to those who sign a service contract. Support is available Monday through Friday from 9:00 A.M. to 5:00 P.M. Pacific time. If @Once Help-Line can't solve your problem over the phone, for $45 per hour it will analyze a copy of a worksheet you send. From PC-Philes, 7510 Sunset Blvd., Suite 516, Hollywood, CA 90046; 800-228-6623, in Calif. 213-850-5622.

CIRCLE 11 ON READER SERVICE CARD

SEC Documents on CD-ROM

Compustat PC Plus Corporate Text uses information provided by SEC Online to provide the full text of annual reports, 10-Ks, 10-Qs, and proxy statements since July 1987 for all New York and American Stock Exchange companies. By January 1990 the product will include national-market-share companies that are listed on NASDAQ, as well as companies that trade on the exchanges but are not based in the United States. The package includes software you use to search for information on the CD-ROM, monthly updates on CD-ROM, a compact-disk reader, training, and support. You can link the program to the vendor's *Compustat PC Plus* software and financial-database system ($18,000 to $45,000 for an annual subscription), and the program can run on a LAN.

Runs on the IBM PC, PS/2, and compatible computers with 640K of RAM. Compatible with any compact-disk reader that supports the Microsoft extensions. A one-year subscription costs $5,000 to $10,000 per year, depending on the products you select and your application. From Standard & Poor's Compustat Services, 7400 South Alton Court, Englewood, CO 80112; 800-525-8640.

CIRCLE 12 ON READER SERVICE CARD

HARDWARE

Copier, Scanner, and Fax That Fit in Your Briefcase

Ricoh's Portable Digital Information System (PDIS) includes a scanner/copy machine, a facsimile machine, an image-controller module, batteries, and cables. PDIS weighs about six pounds and fits into a standard-size briefcase. Each component is available separately. The scanner/copier (MC-50) also prints scanned and faxed images at a resolution of 200 dots per inch. The scanning head and copier output are both size A6, or 3⅞ by 6½ inches. The fax interface (IM-F50) requires an RJ-11 modular phone jack (a jack cord is included, but not the jack). Outgoing fax images are automatically enlarged to 8½ by 11 inches, and incoming faxes are automatically reduced to the MC-50's size A6.

With the image controller (IM-A), you can reduce the scanned images or portions of images by 50%, 70%, or 80% and enlarge them from 120% to 200%. You can produce halftones, mirror images, and reverse images (black to white or vice versa). You can also upload the scanned image to a PC via supplied software and a standard RS-232 cable (not included).

MC-50, $540; IM-A, $510; IM-F50, $540. From Ricoh Corp., Consumer Products Group, 155 Passaic Ave., Fairfield, NJ 07006; 800-225-1899, then dial 4.

CIRCLE 13 ON READER SERVICE CARD

PostScript Laser Printer Connects to a PC or Mac

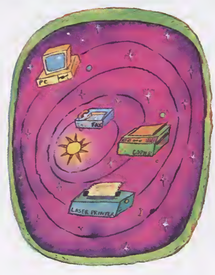
Fujitsu's RX7100PS laser printer comes in 2- and 4-megabyte versions, both of which emulate the Hewlett-Packard LaserJet Series II. Each includes standard interfaces for the IBM PC, Apple Macintosh, or compatible computers. Both use *Adobe PostScript* page-description language, print at a resolution of 300 by 300 dots per inch, process letter- and legal-size paper and envelopes, and print five pages per minute. Both have 35 resident *PostScript* fonts and two 150-sheet paper trays. The front of the printer provides three font-cartridge slots for HP emulation and a slot for the toner and drum cartridges.

$4,495 for the 2-megabyte RX7100PS; $4,995 for the 4-megabyte version. From Fujitsu America, 3055 Orchard Dr., San Jose, CA 95134; 800-626-4686.

CIRCLE 14 ON READER SERVICE CARD

Speed Up Your Old PC

ShortCut is a half-slot accelerator card that boosts the performance of 8088- and 8086-based PCs to 12.5 MHz. The manufacturer claims that the board increases the speed of such computers by a factor of up to 15. The board has 16K of zero-wait-state cache memory, an 80286 CPU, and a socket for an 80287 math coprocessor chip. A $149 Floppy I/O Option with serial and parallel port connections lets you add up to four high-density floppy-disk drives. A $295 Memory Option provides an upgrade path to OS/2 applications by supplying up to 16 megabytes of 16-bit addressable RAM. ShortCut comes with everything you need to install it, including a chip puller, internal cables, and instructions. An external toggle switch lets you flip between accelerated and native modes.



Works with the IBM PC, PC XT, PS/2 Models 25 and 30, all AT&T PCs, Compaq Deskpro, and Amstrad computers. $495, from Tallgrass Technologies, 11100 West 82nd St., Overland Park, KS 66214; 800-825-4727, in Kan. 913-492-6002.

CIRCLE 15 ON READER SERVICE CARD

Eliminate Dedicated Fax Line

The Switch Model A-1 is a unit into which you plug your fax or modem and phone lines, thereby eliminating the need to dedicate a line to each. The Model A-1 senses whether an incoming or outgoing call is in data or voice mode and switches to the correct one automatically. The A-1 is compatible with any G3 fax, dial-up modem, and touch-tone or pulse telephone. You can use the unit on single-line and multiline installations of 110 VAC, 60Hz and 220 VAC, 50Hz, with or without an answering machine.

$159.95, from High-Tech Resources, 230 Main St., Ellsworth, ME 04605; 800-422-2832.

CIRCLE 16 ON READER SERVICE CARD

Heavy-Duty Graphics Controller

The LX6 Professional Controller plugs into your computer to provide 600-by-300 dots-per-inch (dpi) output on the Hewlett-Packard LaserJet Series II/IID, Canon LBP-8II/IIR, Brother HL-8/HL-8e, or any Canon CX-based printer. It prints eight single-side or four duplex pages per minute at 300-by-300 dpi and four single-side pages per minute at 600-by-300 dpi. It includes 35 Bitstream font outlines that adjust to *Adobe PostScript*'s font widths. The board supports software that runs under the Gem and *Microsoft Windows* operating environments and some word-processing programs. It includes a utility for adding more Bitstream fonts. An optional $195 LM CADPack lets you use DXF file formats. A video I/O board and cable come with the package.

Runs with the IBM PC and compatible computers with a hard disk and uses 1.2 megabytes of hard-disk space. $3,995 with 4 megabytes of memory; $5,995 with 6 megabytes of memory (recommended for network use or heavy duplexing only). From LaserMaster Corp., 7156 Shady Oak Rd., Eden Prairie, MN 55344; 612-944-6069.

CIRCLE 17 ON READER SERVICE CARD

TRAINING, REFERENCE

Release 3 Module Comes with Release 2/2.01 Training

Lotus 1-2-3: Beginning Through Advanced Skills includes five modules of courseware for instructor-led or individual-based training. The courseware includes five videotapes, five disks, five guidebooks, and a *1-2-3* command chart. *Moving Up to 1-2-3 Release 3* is a separate course that describes the additional features in Release 3 and is free if you buy the Release 2/2.01 courseware.

Requires *1-2-3* Release 2/2.01 and runs on the IBM PC, PS/2, and compatible computers with 356K of RAM. *Moving Up* requires *1-2-3* Release 3 and runs on the IBM PC AT, PS/2, and compatible computers with 1 megabyte of RAM. $995 for VHS and Beta formats; $1,145 for ¾-inch U-Matic format; $40 for a set of five additional disks and guidebooks. From Learn-PC Video Systems, 5101 Hwy. 55, Minneapolis, MN 55422-5134; 800-532-7672, in Minn. 612-544-4500.

CIRCLE 18 ON READER SERVICE CARD

1-2-3 and WordPerfect Videos

Lotus 1-2-3, Volume 1 (for Release 2.01) and *WordPerfect 5.0, Volume 1* videos introduce the most basic concepts of the respective spreadsheet and word-processing packages. *Lotus 1-2-3, Volume 2* (for Release 2.01) teaches how to write macros, automate a spreadsheet, and create a database.

In VHS format only. $29.95 each, from DiskMasters Corp., P.O. Box 2677, Abilene, TX 79604; 800-444-4714.

CIRCLE 19 ON READER SERVICE CARD

Reference-Card Sets for Use with 1-2-3 and Symphony

GuideCard Set for Lotus 1-2-3 consists of plastic cards that you mount across the top of your keyboard. They provide es-

ROBBIE MARANTZ

sential information about the functions, macros, and commands of *1-2-3* Releases 1A through 2.01. A Functions and Macros card includes descriptions of all @functions and macro commands. A Commands and Functions card includes the same descriptions of @functions, as well as keystrokes for a wide range of worksheet, graph, print, and window operations, among others. GuideCard Set for Lotus Symphony consists of two cards that contain instructions for all *Symphony* environments plus its macros and @functions.

GuideCard for Lotus 1-2-3 Functions and Macros and GuideCard for Lotus 1-2-3 Commands and Functions, $9.99 each or $15.99 for both; Guidecard Set for Symphony is available as a combined set only for $15.99. From Wink Data Products Corp., 5631 208th St. SW, Bldg. L, Lynnwood, WA 98036; 206-771-4583.

CIRCLE 20 ON READER SERVICE CARD

Monthly HyperPad Newsletter

Beginning this month, the 16-page *Inside HyperPad* newsletter offers advanced tips and techniques for designing applications in the Brightbill-Roberts & Co.'s software *HyperPad* (see July New Products, page 142). Yearly subscription, $49. From The Cobb Group, P.O. Box 24480, Louisville, KY 40224; 800-223-8720, in Ky. 502-491-1900.

CIRCLE 21 ON READER SERVICE CARD

UPGRADES

PanaView Version 1.1, a *1-2-3* and *Symphony* add-in that was formerly called *Panorama*, now provides you with mouse drivers. Until September 30, the manufacturer will bundle with the software a mouse that is compatible with Mouse Systems and the Microsoft Mouse. If you use an IBM EGA or VGA board, the program now distinguishes among worksheet cells by displaying labels, values, and formulas in different colors. In addition, when you enable global protection, the program allows you to see which cells are unprotected by displaying them in a highlighted and shaded pattern. Empty cells are displayed with dashed lines.

Requires *1-2-3* Release 2/2.01 or 2.2 or any release of *Symphony*. $145, which includes a free mouse with a cord until September 30, 1989; thereafter, a mouse costs an additional $105; a cordless infrared mouse costs an additional $175. From Intex Solutions, 161 Highland Ave., Needham, MA 02194; 617-449-6222.

CIRCLE 22 ON READER SERVICE CARD

Baler Version 5.0 makes it unnecessary to make any changes to the original worksheet before compiling it. The software works with all of *1-2-3*'s @functions and macro commands. *Baler* lets you compile spreadsheets that are up to 40 megabytes and 32,000 rows in size. It works with expanded and virtual memory. You can create pull-down menus similar to *1-2-3*'s and those of IBM's SAA. To accommodate custom commands, the software lets you enable or disable any command that is invoked by pressing slash. You can also customize the colors and overall appearance of the compiled worksheet. You can now install compiled worksheets on a LAN, lock the files, and protect data from being overwritten.

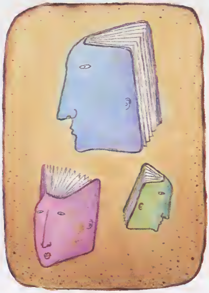
Compiles any WKS or WK1 file and runs on the IBM PC, PS/2, and compatible computers with DOS 2.1 or higher and 512K of RAM. Manufacturer recommends a hard disk. $495; free upgrade to support *1-2-3* Release 2.2 will be available after the release ships. From Baler Software Corp., 2300 North Barrington Rd., Hoffman Estates, IL 60195; 800-327-6108.

CIRCLE 23 ON READER SERVICE CARD

MathEdit Version 1.2 includes an equation editor to use with *Lotus Manuscript* Release 2.1 in place of *Manuscript*'s equation language. As you enter an equation, you see its superscripts, subscripts, symbols, and other unique characters. Because *MathEdit* now supports *PostScript* and encapsulated *PostScript* formats, you can import formatted equations into such programs as *WordPerfect*, *Aldus PageMaker*, and *Xerox Ventura Publisher*.

Runs with the IBM PC, PS/2, and compatible computers with 512K of RAM. $149, from K-Talk Communications, 50 McMillen Ave., Suite 100, Columbus, OH 43201; 614-294-3535.

CIRCLE 24 ON READER SERVICE CARD



BOOKS

The Lotus Guide to 1-2-3 @Functions, by Mary Campbell. Explains how to use @functions in *1-2-3* Releases 1A through 3. Published August, 1989, 275 pages, $19.95 (paperback), from Addison-Wesley Publishing Co., Reading, MA 01867; 617-944-3700.

CIRCLE 25 ON READER SERVICE CARD

The Lotus Guide to Learning 1-2-3, by Lotus Development Corp. Learning guide to *1-2-3* Release 2.2, but not Release 3. Written for beginner and intermediate users. Published September 1989, 650 pages, $22.95 (paperback), from Addison-Wesley Publishing Co., Reading, MA 01867; 617-944-3700.

CIRCLE 26 ON READER SERVICE CARD

1-2-3 Tips, Tricks, and Traps, 3rd Edition, by Dick Andersen. Highlights new features of Release 3. Published September 1989, 550 pages, $22.95 (paperback), from Que Corp., 11711 North College Ave., Carmel, IN 46032; 317-573-2500.

CIRCLE 27 ON READER SERVICE CARD

1-2-3 Release 3 Workbook and Disk, by Lawrence C. Metzelaar and Marianne Fox. Hands-on tutorial for beginners. Published August 1989, 350 pages, $29.95 (paperback), includes disk. From Que Corp., 11711 North College Ave., Carmel, IN 46032; 317-573-2500.

CIRCLE 28 ON READER SERVICE CARD

The Lotus Guide to Freelance Plus Release 3, by Donna Wainwright. Tutorial for the latest *Freelance Plus* release. Published June 1989, 496 pages, $24.95 (paperback), from Addison-Wesley Publishing Co., Reading, MA 01867; 617-944-3700.

CIRCLE 29 ON READER SERVICE CARD

Using Microsoft Word 5, by Greg M. Perry. Covers fundamentals to advanced techniques. Published March 1989, 484 pages, $22.95 (paperback), from Osborne/McGraw-Hill, 2600 Tenth St., Berkeley, CA 94710; 800-227-0900.

CIRCLE 30 ON READER SERVICE CARD

Information for New Products is supplied by the vendors and was up-to-date as of 7/11/89. Since production specifications change frequently, we recommend that you verify this information with a dealer before making a purchase.

ESSAY

THE LOTUS CROSS-PLATFORM STRATEGY

BY JEFFREY TARTER

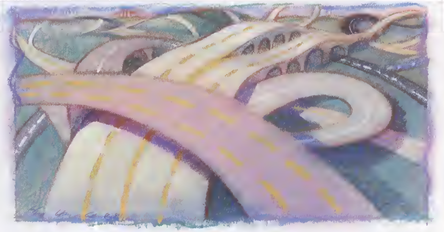
Once upon a time (or so the story goes), it occurred to the top brass at Lotus to wonder about next-generation computer architectures. So the company hired a fortune-teller.

"I see PCs running DOS, OS/2, and eleven flavors of Unix," the crystal-ball gazer murmured. "I see Macintoshes and VAX clusters; I see mainframes, minis, and file servers wired together through networks and gateways. I also see distributed database processing, work-group applications, E-mail, and compound-document architectures. And I have a cousin who reads tea leaves. If you cross her palm with silver, she'll give you the true release dates for your next products."

Lotus bought the fortune-teller's vision (alas, without hiring her tea-leaf-reading cousin) and promptly began redesigning *1-2-3* for an environment of mixed hardware platforms and operating systems. Some parts of this task turned out to be easy to solve; others were unexpectedly daunting.

The easy part, of course, was to find ways to let users move data from one environment to another. Lotus users were already dumping numbers into their spreadsheets from all kinds of sources—mainframe databases, scientific instruments, ticker tapes, accounting programs, and the like. And they were sending data back out over networks to other databases that resided on equally diverse platforms just as easily.

But users pointed out that being able just to import and export raw data wasn't much of a cross-platform strategy. They wanted Lotus to expand its vision a little further and provide a way to move an entire application, such as a budget template or an economic-forecasting model, from one platform to another.



SALLY WERN COMPORT

That was a trickier problem because Lotus would have to create versions of *1-2-3* for other hardware platforms—ranging from Macintoshes to mainframes—with virtually identical feature sets, command structures, screen displays, and macro languages.

In fact, Lotus wasn't the first software company to invent the idea of look-alike versions that run on different platforms. To the considerable chagrin of Apple's lawyers, the *Microsoft Windows* operating environment endows a PC with much of the "look and feel" of a Macintosh. Aldus Corp., Microsoft Corp., and other developers already have *Windows*-based versions of Mac programs that share Mac and PC files without painful conversion procedures.

But Lotus's fortune-teller didn't foresee a world divided only among Mac and PC users. The real future, at least for many of Lotus's corporate customers, is likely to be a hodgepodge of interconnected mainframes, workstations, and personal computers that makes the Los Angeles freeway system look simple. These various platforms move data around in different-size chunks, and they manage memory and video displays in incompatible ways. At the chip level, there are even minor variations in the way different processors perform logical and arithmetic operations.

Clearly, creating a single spreadsheet that works consistently across this broad range of platforms was a huge job—in retrospect, far bigger than Lotus expected. To date, Lotus has managed to deliver only a first installment: *1-2-3* Release 3. Long-promised versions for mainframes, VAXes, Macs, and Unix machines are still in the works. So it may take a few more years before *1-2-3* users actually find themselves whipping data off file servers and shooting a worksheet up to the mainframe for a quick recalc.

Ironically, Lotus's cross-platform strategy has already had one unhappy consequence—a bit less compatibility for *1-2-3* on the PC itself. Earlier versions of *1-2-3* always ran on everything from dual-floppy-disk PCs to the snappiest 80386 models. Now, because *1-2-3* Release 3 is too big for most low-end machines, Lotus finds itself in the position of supporting two versions of *1-2-3* for a single hardware platform and operating system.

That's a glitch the Lotus fortune-teller forgot to mention. ■

Jeffrey Tarter is publisher and editor of Softletter, *a software-publishing newsletter based in Cambridge, Mass.*

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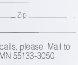

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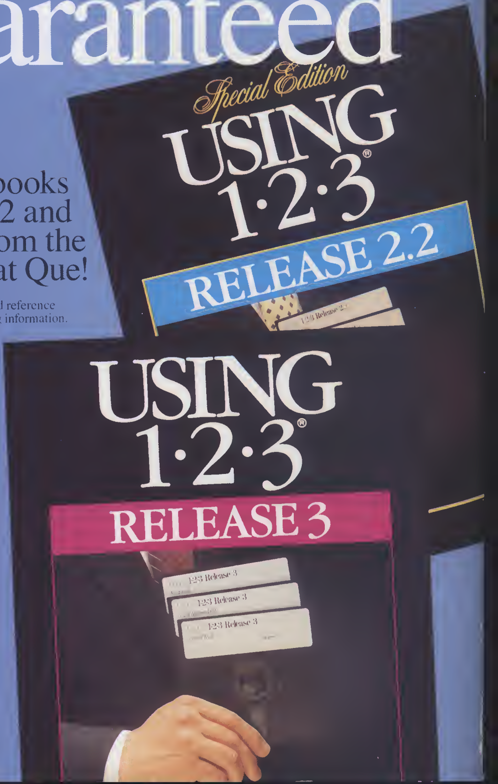

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